A Review of Yellow Perch (*Perca Flavascens*), Smallmouth Bass (*Micropterus Dolomieu)*, Largemouth Bass (*Micropterus Salmoides*), Pumpkinseed (*Lepomis Gibbosus*), Walleye (*Sander Vitreus*) and Northern Pike (*Esox Lucius*) Distributions in British Columbia

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A REVIEW OF YELLOW PERCH (*Perca flavascens*), SMALLMOUTH BASS (*Micropterus dolomieu*), LARGEMOUTH BASS (*Micropterus salmoides*), PUMPKINSEED (*Lepomis gibbosus*), WALLEYE (*Sander vitreus*) AND NORTHERN PIKE (*Esox lucius*) DISTRIBUTIONS IN BRITISH COLUMBIA.

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ABSTRACT

Runciman, J.B. and Leaf, B.R. 2009. A review of yellow perch (*Perca flavascens*), smallmouth bass (*Micropterus dolomieu)*, largemouth bass (*Micropterus salmoides)*, pumpkinseed (*Lepomis gibbosus*), walleye (*Sander vitreus*) and northern pike (*Esox lucius*) distributions in British Columbia. Can. Manuscr. Rep. Fish. Aquat Sci 2882: xvi + 123 p.

This report provides a summary of existing information regarding yellow perch, smallmouth bass, largemouth bass, pumpkinseed, walleye and northern pike distributions in BC as of 2008. Pike and walleye are native to portions of northern BC and yellow perch may be native to a few locations in the Peace River drainage. All six species have been introduced to southern BC, initially as either part of government-led programs to enhance fishing opportunities in the early 1900s or by dispersal from Washington State via tributaries of the Columbia River. To varying degrees these species are now being illegally introduced into other waterbodies in BC. Published or oral information on the likely date of introduction of these species to lakes and streams is included, as well as the inferred mode of introduction. This document provided a snapshot of the status of these non-native species in BC in 2008 and will be a benchmark to track future trends.

RÉSUMÉ

Runciman, J.B. and Leaf, B.R. 2009. A review of yellow perch (*Perca flavascens*), smallmouth bass (*Micropterus dolomieu)*, largemouth bass (*Micropterus salmoides)*, pumpkinseed (*Lepomis gibbosus*), walleye (*Sander vitreus*) and northern pike (*Esox lucius*) distributions in British Columbia. Can. Man. Rep. Fish. Aquat Sci 2882: xvi + 123 p.

Ce rapport présente un sommaire des renseignements dont on dispose en 2008 sur la répartition de la perchaude, de l'achigan à petite bouche, de l'achigan à grande bouche, du crapet-soleil, du doré jaune et du grand brochet en Colombie-Britannique. Le brochet et le doré jaune sont des poissons indigènes des parties du nord de la Colombie-Britannique, et la perchaude pourrait être un poisson indigène de divers endroits dans le bassin hydrographique de la rivière de la Paix. Les six espèces ont été introduites dans le sud de la Colombie-Britannique, initialement dans le cadre de programmes gouvernementaux visant à améliorer les possibilités de pêche, au début des années 1900, ou encore par la dispersion en provenance de l'État de Washington par des affluents du fleuve Columbia. À divers degrés, ces espèces sont aujourd'hui introduites illégalement dans d'autres cours d'eau de la Colombie-Britannique. Le présent rapport comporte des renseignements publiés ou obtenus verbalement sur la date d'introduction probable de ces espèces dans les lacs et les cours d'eau, ainsi que sur le mode d'introduction présumé. Le présent document est un portrait éclair de la situation de ces espèces non indigènes en 2008, en Colombie-Britannique, et il servira de point de référence pour suivre les tendances futures.

INTRODUCTION

Alien invasive species are non-native species which become established in natural or semi-natural ecosystems or habitats, are agents of change, and threaten native biological diversity (IUCN 2000). The impact of such species on native freshwater fish and fish habitats is an issue of increasing concern to Canadian fisheries managers (CCFAM 2004). Alien invasive species have been described as the second most prevalent threat for Canadian freshwater fish species at risk next to habitat loss (Dextrase and Mandrak 2006).

In British Columbia (BC), threats posed by alien invasive species to freshwater fish populations and recreational fisheries were recently identified as a key issue in the Ministry of Environment (MOE) Freshwater Fisheries Program Plan (BC MOE 2007a). The potential scope of this issue was described by Hatfield and Pollard (2006), who identified a total of 17 alien or translocated native fish species as occurring within the province. Of these species, six species were considered to pose potentially high impacts to provincial-scale biodiversity: brown trout, smallmouth and largemouth bass, walleye, brook trout and northern pike. Introduced species of the Orders Perciformes (Families Centrarchidae and Percidae) and Esociformes (Family Esocidae) - including yellow perch, smallmouth and largemouth bass, pumpkinseed, black crappie, walleye and northern pike - are of particular concern to many provincial fisheries managers due to their broad physiological tolerances and their capacity to dominate native freshwater species and habitats through competition and predation (Erin Stoddard, BC MOE Regional Biologist, pers. comm.; Jeff Burrows, BC MOE Regional Biologist, pers. comm.; Steve Maricle, BC MOE Regional Biologist, pers. comm.; Trevor Andrews, BC MOE Regional Biologist, pers. comm.). Collectively, these species are referred to as "spiny-rayed fishes" by regional BC MOE staff.

The potential for invasive freshwater fish species to negatively impact freshwater life stages of Pacific salmon was also recently recognized by federal fisheries managers. This recognition was driven, in part, by the collapse of a number of provincially-managed trout fisheries in stocked headwater lakes of BC watersheds containing Pacific salmon following the introduction and establishment of yellow perch, smallmouth bass, largemouth bass and/or pumpkinseed. Another contributing factor was the proposed eradication of a number of these introduced fish populations in the BC Interior by the BC MOE, which required enabling regulatory decisions by Fisheries and Oceans Canada (DFO) under the Fisheries Act and the Canadian Environmental Assessment Act.

To better understand the scope and degree of potential threat posed by yellow perch, smallmouth bass, largemouth bass, pumpkinseed, walleye and northern pike to Pacific salmon populations in freshwater habitats of BC, and to inform future regulatory decisions, DFO, Pacific Region, recently initiated biological risk assessments for these species under the guidance of the Department's Centre of Expertise for Aquatic Risk Assessment (CEARA 2007). This review of

existing distribution information for yellow perch, smallmouth bass, largemouth bass, pumpkinseed, walleye and northern pike in BC was initiated in support of these risk assessment activities.

PURPOSE AND RATIONALE

The purpose of this report is to provide a current summary of existing information regarding yellow perch, smallmouth bass, largemouth bass, pumpkinseed, walleye and northern pike distributions in BC. Though Hatfield and Pollard (2006) completed a similar, and somewhat more comprehensive, summary based on digital datasets maintained by provincial and federal fisheries agencies, pers. comm.s with provincial and federal fisheries agency staff, records maintained by the University of BC Museum and consultant reports and other published literature known to the authors, an initial review of their digital dataset identified substantial duplication of occurrence records for species of interest, dated occurrence records that lacked recent confirmation and incomplete or conflicting waterbody and geographic reference information. Subsequent discussions with provincial fisheries managers further revealed that a substantial number of confirmed and unconfirmed occurrence records were not identified by Hatfield and Pollard (2006) as they had yet to be entered into provincial fisheries datasets.

The issues noted above should not be construed as criticism of the process or products developed by Hatfield and Pollard (2006), rather as inherent pitfalls of using multiple information sources, and particularly multi-agency digital datasets and historical records, to determine current species distributions.

METHODS

Prior to inclusion in this report, distribution data complied by Hatfield and Pollard (2006) for yellow perch, smallmouth bass, largemouth bass, pumpkinseed, walleye and northern pike were reviewed to group duplicate records and associated reference citations as single waterbody occurrence records and determine and ensure agreement between gazetted and local waterbody names, provincial watershed codes and waterbody identifiers (Spatial Vision Consulting Ltd. 1996) and Universal Transverse Mercator and latitude and longitude geographic references. Resultant waterbody occurrence records were reviewed with regional fisheries staff of the BC MOE to identify errors and omissions as well as existing fisheries values for each waterbody, known impacts to previous or existing fisheries values and the existence of management plans to address known impacts.

Physical and biological characteristics of waterbodies containing the species of interest were determined through online queries of the Habitat Wizard (http://www.env.gov.bc.ca/habwiz/) and Fisheries Data Warehouse

(http://a100.gov.bc.ca/pub/fidq/main.do) datasets maintained by the BC MOE and the Fish Wizard (http://www.fishwizard.com/) dataset, operated and maintained by the Freshwater Fisheries Society of BC in partnership with the BC government. Species occurrence records, physical and biological characteristics and fisheries values of affected waterbodies, known impacts to fisheries values and the existence of management plans to address such impacts were recorded in Microsoft® Excel 2002 spreadsheet format to support data queries, sorts and summaries (see Appendices 1 and 2).

Confirmed and unconfirmed occurrence records for each of the six species of interest were mapped at the provincial scale as ArcInfo® GIS point coverages. Occurrence records were also tabulated for each species by BC MOE Region (Table 1). Within these tables, waterbody names were arranged hierarchically according to BC MOE watershed coding to depict parent-tributary flow relationships and aid in the interpretation of modes of species introduction and spread. Species occurrence records were classified as confirmed where multiple occurrence reports existed for a single waterbody or where a single occurrence report was supported by a voucher specimen or received from a source deemed reliable by BC MOE regional fisheries staff.

For yellow perch, confirmed and unconfirmed occurrence records were also extrapolated to downstream areas based on the ecology of the species and local knowledge of BC MOE fisheries staff regarding connectivity, habitat conditions and seasonal flow characteristics of source and receiving waters. Extrapolations were not extended beyond the lowermost stream or lake referenced by an occurrence record's watershed code and waterbody identifier regardless of conditions further downstream. Confirmed, unconfirmed and extrapolated distributions of yellow perch within each BC MOE Region were mapped as area and line coverages using ArcInfo® GIS. Subsequent queries provided estimates of infested lake area and stream length. Together, these maps and query results provide the best available estimate of current yellow perch distribution in BC. Time and resource constraints precluded similar extrapolations, maps and queries being completed for smallmouth bass, largemouth bass, pumpkinseed, walleye and northern pike. These constraints also precluded the completion of fisheries impact and management plan summaries for all six species of interest.

DISTRIBUTION ACCOUNTS

YELLOW PERCH

Current Distribution in BC

Yellow perch presence was confirmed for 78 waterbodies in BC, including 59 lakes or ponds and 19 streams. Unconfirmed records of yellow perch presence were recorded for an additional three lakes and one stream. The distribution of these records across the Province is illustrated in Figure 1.

Confirmed and unconfirmed records of yellow perch presence are distributed across six regional fisheries management areas of the BC MOE. For the purposes of this report, and based on the local knowledge of provincial fisheries managers, yellow perch presence was extrapolated to an additional 38 waterbodies, including six lakes and 32 streams. Names and tributary relationships for confirmed, unconfirmed and extrapolated records of yellow perch within the broad geographic regions of their provincial range are detailed in Tables 2, 6, 9, 12 and 15, below. A brief account of local yellow perch distributions within these regions, including timing and mode of introduction and presence of other fish species with which yellow perch may interact, are provided below. As only a single yellow perch occurrence was identified in the Lower Mainland Region (lower Fraser River watershed), this region has been grouped with the Vancouver Island Region (Vancouver and Gulf Islands) in the text below.

Distribution, Timing and Mode of Invasion and Spread

The present distribution of yellow perch within BC is broadly comprised of geographically, physically and/or hydrologically isolated individual lakes or small lake groups and directly associated inlet and outlet streams. Exceptions to this pattern are large mainstem lakes and rivers (e.g. Okanagan River) and inter-provincial (e.g. Peace River) or international (e.g. Lake Koocanusa) trans-boundary systems that provide favourable habitat for yellow perch and may have served as avenues of introduction or dispersal for the species.

Vancouver Island and Lower Mainland Regions (Vancouver and Gulf Islands and the Lower Fraser River Watershed)

Yellow perch presence was confirmed for eight waterbodies on Vancouver and Saltspring Islands and one waterbody in the lower Fraser River watershed, including eight lakes and one stream (see Table 2). An unconfirmed occurrence of yellow perch was identified for one additional waterbody, Loon Lake, on Vancouver Island. The distribution of yellow perch across these areas is illustrated in Figures 2 and 3. Characteristic of yellow perch occurrences in the province, these records consist of isolated individual lakes or small lake groups and directly associated inlet and outlet streams.

The first recorded occurrence of yellow perch on Vancouver Island was in Elk and Beaver Lakes in 1997 (University of BC Museum record, cited in Hatfield and Pollard 2006). The most recent new occurrence for this species was in Shawnigan Lake in 2001 (Best 2001, cited in Hatfield and Pollard 2006). No yellow perch populations in the Vancouver Island or Lower Mainland Regions originated through authorized stocking activities (Trevor Andrews, BC MOE Regional Biologist, pers. comm.; Erin Stoddard, BC MOE Regional Biologist, pers. comm.). This, together with a lack of physical connectivity between waterbodies containing yellow perch, indicates that these populations originated exclusively through unauthorized introductions.

Physical attributes of Vancouver Island and Lower Mainland Region lakes containing yellow perch are detailed in Table 3. Based on available data, yellow perch may occupy over 61 km of lake perimeter, over 1,144 ha of lake surface area and over 497 ha of lake littoral area on Vancouver and Saltspring Islands and in the lower Fraser River watershed.

Physical attributes of Vancouver Island and Lower Mainland Region streams containing yellow perch are detailed in Table 4. Based on available data, yellow perch may now occupy over three kilometres of stream length on Vancouver and Saltspring Islands. This relatively low value, particularly in comparison to potentially occupied lake perimeter, lake surface and lake littoral area, is due to the lack of confirmed or unconfirmed records of yellow perch in lake inlet or outlet streams.

Based on the local knowledge of regional fisheries staff of the BC MOE (Trevor Andrews BC MOE Regional Biologist, pers. comm.; Erin Stoddard, BC MOE Regional Biologist, pers. comm.), yellow perch distributions were extrapolated to an additional ten streams and one lake in the Vancouver Island Region (Figures 2 and 3). Based on available data, this may represent as much as 52.5 km of additional stream length, over 1.4 km of lake perimeter and approximately 2.7 ha of lake surface area occupied by yellow perch (Tables 3 and 4). Yellow perch distributions were not extrapolated beyond Judson Lake in the Lower Mainland Region as this international trans-boundary system has no inlet or outlet streams in Canada. That even extrapolated stream distributions for yellow perch do not provide physical connectivity among confirmed and unconfirmed occurrences in the Vancouver Island or Lower Mainland Regions supports the conclusion that these populations originated through independent unauthorized introductions rather than through introduction and dispersal.

Vancouver and Saltspring Islands and lower Fraser River watershed lakes and streams containing confirmed and unconfirmed populations of yellow perch support a variety of native and other non-native species including Atlantic salmon, burbot, black catfish, brown catfish, chinook and coho salmon, cutthroat trout, prickly sculpin, eastern brook trout, kokanee, lake whitefish, pumpkinseed, rainbow trout, starry flounder, smallmouth bass, steelhead and threespine

stickleback. However, the presence and abundance of these species varies widely among individual lakes and streams.

Two of ten waterbodies containing confirmed or unconfirmed populations of yellow perch provide habitat for salmon, while an additional seven are connected by surface waters to downstream salmon populations (Table 5). Nine waterbodies containing confirmed or unconfirmed yellow perch populations provide habitat for native sportfish or other native species and downstream connectivity to native sportfish or other native species downstream. Seven of ten lake and stream systems containing confirmed or unconfirmed populations of yellow perch also contain other non-native spiny-rayed fish species.

Thompson Region (South Thompson River Watershed)

Yellow perch presence was confirmed for 12 waterbodies draining to the South Thompson River, including nine lakes and three streams (see Table 6).[1] These occurrence records again consist of isolated individual lakes or small lake groups and their directly associated inlet and outlet streams as is characteristic of most yellow perch occurrences in BC (Figure 4).

The first recorded occurrence of yellow perch in the South Thompson River watershed was in Skmana Lake in 1996 (Ken Tsumura, pers. comm., cited in Hatfield and Pollard 2006). The most recent new occurrences for this species were in Cedar and Sinmax Creeks in 2007 (Steve Maricle, BC MOE Regional Biologist, pers. comm.; David Southgate, DFO Area Technician, pers. comm.). No yellow perch populations in the Thompson Region originated through authorized stocking activities, though it is believed that populations in Fleming and Skimikin Lakes were established through unauthorized upstream stocking of Phillips Lake and subsequent downstream dispersal through a seasonal outlet channel (Steve Maricle, BC MOE Regional Biologist, pers. comm.). Given the presence of fish passage obstructions downstream, yellow perch captured in Hiuihill Creek in 2006 and Sinmax Creek in 2007 must also have originated from upstream populations in Skmana Lake and Forest Lake, respectively. Thus, excepting the incidents of localized dispersal noted above, yellow perch populations in the Thompson Region originated exclusively through unauthorized introductions.

Physical attributes of Thompson Region lakes containing yellow perch are detailed in Table 7. Based on available data, yellow perch may occupy nearly 24 km of lake perimeter, over 246 ha of lake surface area and over 61 ha of lake littoral area. Physical attributes of Thompson Region streams containing yellow perch are detailed in Table 8. Based on available data, yellow perch may now occupy over 26 km of stream length in higher order tributaries to the South Thompson River.

[1] For the purposes of this report, Gardom Lake and Gardom Creek, which drain to the South Thompson River via Shuswap Lake but are managed by the BC MOE Okanagan Region, were considered to fall within the Thompson Region.

Based on the local knowledge of regional fisheries staff of the BC Ministry of Environment (Steve Maricle, BC MOE Regional Biologist, pers. comm.), yellow perch distributions were extrapolated to an additional four streams in the Thompson Region (Figure 4). Based on available data, this may represent over nine kilometres of additional stream length occupied by yellow perch (Table 8). Again, that extrapolated stream distributions for yellow perch do not provide physical connectivity among confirmed and unconfirmed occurrences in the Thompson Region supports the conclusion that these populations originated through independent unauthorized introductions and subsequent localized dispersal.

Lakes and streams of the South Thompson River watershed containing confirmed and unconfirmed populations of yellow perch are primarily headwater systems, supporting a number of native and other non-native species including cutthroat trout, eastern brook trout, lake chub, lake trout, largescale sucker northern pikeminnow, peamouth chub, rainbow trout and redside shiner. Exceptions are provided by Hiuihill and Sinmax Creeks which also support chinook, coho and sockeye salmon in their lowermost reaches. Nine additional waterbodies containing confirmed or unconfirmed populations of yellow perch directly support native sportfish or other native species (Table 5). Altogether, seven Thompson Region waterbodies containing confirmed or unconfirmed populations of yellow perch are connected by surface waters to downstream salmon populations while nine are connected to downstream native sportfish or other native species. Two of 12 lake and stream systems containing confirmed or unconfirmed populations of yellow perch have also been found to contain other non-native spiny-rayed fish species.

Kootenay Region (Upper Columbia River (Kootenay) Watershed)

Thirty-one waterbodies in the Kootenay watershed contain confirmed populations of yellow perch, including 22 lakes and nine streams (see Table 9). The distribution of yellow perch occurrences across the Kootenay Region is illustrated in Figures 5 and 6. While a portion of Kootenay Region occurrence records exhibit the isolated individual lake or small lake group and associated inlet and outlet stream distribution that is characteristic of yellow perch occurrences in BC, three large mainstem rivers (i.e., the Columbia, Pend D'Oreille and Kootenay Rivers) and associated mainstem lakes (i.e., Lower Arrow, Kootenay and Koocanusa Lakes) provide a broad and contiguous species distribution that is paralleled only in the lower Columbia River (Okanagan) watershed. Floodplain streams, lakes and wetlands adjacent to the inlet of the Kootenay River on Kootenay Lake provide additional, extensive, contiguous habitat for yellow perch that is unique to the Kootenay Region in BC (see Figure 5).

The first recorded occurrence of yellow perch in the Kootenay watershed was in 1956 in the Pend D'Oreille River (Ken Tsumura, pers. comm., cited in Hatfield and Pollard 2006) and Kootenay Lake (University of BC Museum record, cited in

Hatfield and Pollard 2006). The most recent new occurrence for this species was in the Columbia River mainstem, downstream of Lower Arrow Lake, in 2004 (Bronwen Lewis, pers. comm., cited in Hatfield and Pollard 2006). No yellow perch populations in the Kootenay Region originated through authorized stocking activities within Canada (Albert Chirico, BC MOE Regional Biologist, pers. comm.). However, in two instances, namely Lake Koocanusa and Kootenay Lake, yellow perch are thought to have dispersed into Canada from the United States (Huston *et al.* 1984, cited in Hatfield and Pollard 2006; Northcote 1973). These movements likely also resulted in yellow perch presence in unobstructed contiguous waters. Similarly, unauthorized introduction followed by subsequent, localized dispersal is thought to have resulted in yellow perch becoming established in several, otherwise isolated, small drainage basins of the Kootenay Region (e.g. Bednorski, Alta, Haha and Lund Lakes) (Albert Chirico, BC MOE Regional Biologist, pers. comm.). Excepting these incidents of trans-boundary and localized dispersal, yellow perch populations in the Kootenay Region are thought to have originated through unauthorized introductions (Albert Chirico, BC MOE Regional Biologist, pers. comm.).

Physical attributes of Kootenay Region lakes containing yellow perch are detailed in Table 10. Based on available data, yellow perch may occupy over 855 km of lake perimeter, over 68,162 ha of lake surface area and over 144 ha of lake littoral area within the Kootenay watershed. Physical attributes of Kootenay Region streams containing yellow perch are detailed in Table 11. Based on available data, yellow perch may now occupy over 198 km of stream length in this area of the Province.

Based on the local knowledge of regional fisheries staff of the BC MOE (Albert Chirico, BC MOE Regional Biologist, pers. comm.), yellow perch distributions were extrapolated to an additional ten streams and five lakes in the Kootenay Region (Figures 5 and 6). Based on available data, this may represent over 351 km of lake perimeter, nearly 23,000 ha of lake surface area and 34.2 km of additional stream length occupied by yellow perch (see Tables 10 and 11). Again, that extrapolated stream distributions for yellow perch do not provide physical connectivity among all confirmed and unconfirmed occurrences in the Kootenay Region supports the conclusion that these populations originated through a combination of independent unauthorized introductions and localized small basin and international trans-boundary dispersal.

Kootenay watershed lakes and streams containing confirmed or unconfirmed populations of yellow perch support a diverse array of native and other non-native species including burbot, black crappie, black catfish, bridgelip sucker, bull trout, prickly sculpin, mottled sculpin, slimy sculpin, shorthead sculpin, chiselmouth, carp, torrent sculpin, largescale sucker, cutthroat trout, eastern brook trout, brown trout, Arctic grayling, kokanee, leopard dace, lake chub, largemouth bass, longnose dace, longnose sucker, lake trout, lake whitefish, Montana grayling, northern mountain sucker, mountain whitefish, northern pikeminnow, peamouth chub, pumpkinseed, pygmy whitefish, rainbow trout,

redside shiner, American shad, tench, Umatilla dace, walleye and white sturgeon. As in other regions, the presence and abundance of these species varies widely among individual lakes and streams. In summary, 26 of 31 waterbodies containing confirmed or unconfirmed populations of yellow perch provide habitat for native sportfish or other native species. Twenty waterbodies are connected by surface waters to native sportfish or other native species downstream. Twenty-seven of 31 lake and stream systems containing confirmed or unconfirmed populations of yellow perch also contain other non-native spiny-rayed fish species. Migratory salmon are presently absent from the Kootenay watershed due to obstructions posed by a succession of downstream hydroelectric dams.

Okanagan Region (Lower Columbia River (Okanagan) Watershed)

Seventeen waterbodies in the Okanagan watershed contain confirmed populations of yellow perch, including 15 lakes and two streams (see Table 12). Unconfirmed yellow perch occurrences were recorded for one additional lake and one stream. The distribution of yellow perch occurrences across the Okanagan Region is illustrated in Figure 7. A portion of occurrence records in the Okanagan Region exhibit the isolated individual lake or small lake group and associated inlet and outlet stream distribution that is characteristic of yellow perch occurrences in BC. However, as in the Kootenay Region, a large mainstem river (i.e., the Okanagan River) and its associated mainstem lakes (i.e., Okanagan, Skaha, Vaseux and Osoyoos Lakes) provide a broader and more contiguous species distribution than is seen elsewhere in BC.

The first occurrence of yellow perch in the Okanagan watershed identified by Hatfield and Pollard (2006) was in 1951 in Osoyoos Lake (University of BC Museum record, cited in Hatfield and Pollard 2006) and Shannon Lake (Lyons 1951, cited in Hatfield and Pollard 2006). However, Dymond (1936) records this species as being present in Vaseaux Lake (sic.) as early as 1928. The most recent new occurrence for yellow perch was in an isolated pond on the Royal York Golf Course in Armstrong, BC, in 2007 (Brent Smith, Conservation Officer, MOE Region, pers. comm.). No yellow perch populations in the Okanagan Region originated through authorized stocking activities within Canada (Brian Jantz, BC MOE Regional Biologist, pers. comm.). It is possible, however, that yellow perch in Osoyoos Lake - an international trans-boundary waterbody - may have dispersed into Canada from the US. Such movements may have also resulted in yellow perch presence in unobstructed contiguous waters (e.g. Vaseaux Lake (sic.), per Dymond (1936)). Similarly, unauthorized headwater lake introductions (e.g. Swan Lake) followed by localized dispersal may have resulted in yellow perch becoming established in upper mainstem lakes of the Okanagan River system (e.g. Okanagan and Skaha Lakes). Excepting these incidents of trans-boundary and localized dispersal, yellow perch populations in the Okanagan Region are thought to have originated through unauthorized introductions (Brian Jantz, BC MOE Regional Biologist, pers. comm.).

Physical attributes of Okanagan Region lakes containing yellow perch are detailed in Table 13. Based on available data, yellow perch may occupy over 441 km of lake perimeter, over 42,300 ha of lake surface area and over 630 ha of lake littoral area within the Okanagan watershed. Physical attributes of Okanagan Region streams containing yellow perch are detailed in Table 14. Based on available data, yellow perch may now occupy over 33 km of stream length in this area of the Province.

Based on the local knowledge of regional fisheries staff of the BC Ministry of Environment (Brian Jantz, BC MOE Regional Biologist, pers. comm.), yellow perch distributions were extrapolated to an additional six streams and one lake in the Okanagan Region (Figure 7). Based on available data, this may represent as much as 67.1 km of additional stream length and 856 m and 3.1 ha of lake perimeter and lake surface area, respectively, occupied by yellow perch (see Tables 13 and 14). Again, that extrapolated stream distributions for yellow perch do not provide physical connectivity among all confirmed and unconfirmed occurrences in the Okanagan Region supports the conclusion that these populations originated through a combination of independent unauthorized introductions, localized dispersal and international trans-boundary dispersal.

Okanagan watershed lakes and streams containing confirmed or unconfirmed populations of yellow perch support a wide range of native and other non-native species including burbot, black crappie, eastern brook trout, cutthroat trout, kokanee, largemouth bass, lake trout, lake whitefish, mountain whitefish, pumpkinseed, rainbow trout, smallmouth bass and steelhead. As in other regions, the presence and abundance of these species varies widely among individual lakes and streams. Of waterbodies containing confirmed or unconfirmed populations of yellow perch, only Osoyoos Lake presently provides habitat for migratory salmon. However, an ongoing experimental outplant of sockeye salmon fry above low head dams on the Okanagan River into Skaha Lake presently provides this species with access to Vaseux and Gallagher Lakes. Sixteen of 19 confirmed or unconfirmed yellow perch waterbodies also support native sportfish or other native species (Table 5). Eight Okanagan Region waterbodies containing yellow perch are connected by surface waters to downstream areas supporting migratory salmon while 10 are connected to areas supporting resident sportfish or other native species. Ten of 19 lake and stream systems containing confirmed or unconfirmed populations of yellow perch also contain other non-native spiny-rayed fish species.

Peace Region (Peace River Watershed)

Yellow perch presence was confirmed for nine waterbodies in the Peace River watershed, including five lakes and four streams (see Table 15). Kelly Lake, thought to regularly winterkill (Brendan Anderson, BC MOE Regional Biologist, pers. comm.), was identified as an additional unconfirmed record. The distribution of yellow perch occurrences across Peace Region is illustrated in Figure 8. Excepting contiguous waters of Swan Lake and the Tupper, Pouce Coupe and Peace Rivers, yellow perch records in the Peace Region consist of isolated individual lakes or small lake groups and directly associated inlet and outlet streams.

The first recorded occurrence of yellow perch in the Peace Region was in 1977 in Swan Lake (University of BC Museum record, cited in Hatfield and Pollard 2006). This waterbody is occasionally cited as being within the native range of the yellow perch (McPhail and Carveth 1994). Though local accounts indicate the Swan Lake population originated from stocking of fish from Sturgeon Lake and/or Winagami Lake in Alberta between 1969 and 1980 (Brendan Anderson, BC MOE Regional Biologist, pers. comm.), McPhail (2007) notes that yellow perch were recorded in Swan Lake as early as 1956 and speculates that the original population may have been native. The most recent new occurrence for yellow perch in the Peace River watershed was in Blackhawk Lake in 2001 (Harvey 2001, cited in Hatfield and Pollard 2006).

Unlike other BC regions, several yellow perch populations in the Peace River watershed were established by way of government stocking activities (Brendan Anderson, BC MOE Regional Biologist, pers. comm.). These include Stony Lake (1982, 1984), Kelly Lake (1984), Bearhole Lake (1984) and Charlie Lake (1981) (Ableson 1990; Hammond 1984; Brendan Anderson, BC MOE Regional Biologist, pers. comm.). Based on the close proximity of Bearhole and Blackhawk Lakes, and the likelihood that Blackhawk Lake experiences regular winterkill, yellow perch observed in Blackhawk Lake in 2001 likely originated from the stocked Bearhole Lake population via low gradient headwaters of the Kiskatinaw River (Brendan Anderson, BC MOE Regional Biologist, pers. comm.). Excepting the contiguous waters of Swan Lake and the Tupper, Pouce Coupe and Peace Rivers, stocked populations of yellow perch in the Peace Region are not expected to have dispersed beyond directly associated inlet and outlet streams due to unfavourable downstream habitat conditions (Brendan Anderson, BC MOE Regional Biologist, pers. comm.). Given that yellow perch are present in the Peace River mainstem downstream of the BC - Alberta border, it is unclear whether the Tupper, Pouce Coupe and Peace River populations originated by upstream movement from Alberta, dispersal of the stocked Swan Lake headwater population or some combination thereof (Brendan Anderson, BC MOE Regional Biologist, pers. comm.).

Physical attributes of Peace Region lakes containing yellow perch are detailed in Table 16. Based on available data, yellow perch may occupy over 83 km of lake

perimeter, over 3,000 ha of lake surface area and over 1,700 ha of lake littoral area within the Peace River watershed. Physical attributes of Peace Region streams containing yellow perch are detailed in Table 17. Based on available data, yellow perch may also occupy nearly 452 km of stream length in this area of the Province.

Based on the local knowledge of regional fisheries staff of the BC Ministry of Environment (Brendan Anderson, BC MOE Regional Biologist, pers. comm.), yellow perch distributions were extrapolated to two streams in the Peace Region (Figure 8). Based on available data, this may represent as much as 31.7 km of additional stream length occupied by yellow perch (see Table 17).

Lakes and streams of the Peace River watershed containing confirmed or unconfirmed populations of yellow perch support a variety native and other non-native species including Arctic grayling, brook stickleback, eastern brook trout, bull trout, burbot, cutthroat trout, Dolly Varden, finescale dace, flathead chub, goldeye, kokanee, lake chub, lake trout, lake whitefish, largescale sucker, longnose dace, longnose sucker, mottled sculpin, mountain whitefish, northern pearl dace, northern pike, northern pikeminnow, northern redbelly dace, peamouth chub, prickly sculpin, pygmy whitefish, rainbow trout, redside shiner, slimy sculpin, spoonhead sculpin, spottail shiner, troutperch, walleye and white sucker. Most of these thirty-four species occurrences are from the species-rich Peace River mainstem, with other systems ranging from two to 11 recorded fish species. Nonetheless, all 10 confirmed and unconfirmed yellow perch waterbodies directly provide and are connected to downstream waters that provide habitat for native sportfish and other native species (Table 5). Nine of 10 lake and stream systems containing confirmed or unconfirmed populations of yellow perch also contain other native or introduced spiny-rayed fish species. Migratory salmon are absent from the upper Peace River watershed.

SMALLMOUTH BASS

Current Distribution in BC

Smallmouth bass presence was confirmed for 70 waterbodies in BC, including 49 lakes or ponds and 21 streams. Unconfirmed occurrences of smallmouth bass were recorded for an additional four lakes and one stream. The distribution of these records across the Province is illustrated in Figure 9.

Confirmed and unconfirmed records of smallmouth bass presence are distributed across six regional fisheries management areas of the BC MOE. Names and tributary relationships for confirmed and unconfirmed records of smallmouth bass within the broad geographic regions of their provincial range are detailed in Tables 18, 23, 26, 28, 31 and 35, below. A brief account of local smallmouth bass distributions within these regions, including timing and mode of introduction and presence of other fish species with which smallmouth bass may interact, are provided below.

Distribution, Timing and Mode of Invasion and Spread

Similar to yellow perch, the present distribution of smallmouth bass within BC is broadly comprised of geographically, physically and/or hydrologically isolated individual lakes or small lake groups and directly associated inlet and outlet streams. Again, large mainstem lakes and rivers (e.g. Osoyoos Lake and Okanagan River) and international trans-boundary systems (e.g. Pend D'Oreille River) that provide favourable habitat for smallmouth bass are exceptions to this pattern and may have served as avenues of introduction and dispersal.

Vancouver Island Region (Vancouver and Gulf Islands)

Smallmouth bass presence was confirmed for 50 waterbodies on Vancouver and the Gulf Islands, including 36 lakes and 14 streams (see Table 18). Unconfirmed occurrences for smallmouth bass were recorded for three additional lakes. Based on provincial watershed coding, confirmed and unconfirmed occurrence records for this species are distributed across 20 separate drainages, linked only by marine or estuarine waters.

The first occurrence of smallmouth bass in the Vancouver Island Region identified by Hatfield and Pollard (2006) was in 1950 in Young Lake (Balkwill 1950, cited in Hatfield and Pollard 2006). The most recent occurrence for this species was in First Nanaimo Lake in 2007 (Brian Banks, Nanaimo River Hatchery, pers. comm. to Tom G. Brown, DFO Pacific Biological Station). Provincial records contain no accounts of authorized smallmouth bass stocking on Vancouver or the Gulf Islands. However, four lakes, including St. Mary, Spider, Langford and Florence Lakes, were stocked with "Bass/Sunfish (General)" during the period of 1901 through 1923 (see Table 19). Excepting St. Mary Lake, where an early introduction may not have successfully established, these systems are known to contain smallmouth bass, largemouth bass and pumpkinseed. Thus, it is difficult to determine which species was historically stocked. Dymond (1936) refers to stocking of smallmouth bass in various BC waterbodies by the federal Department of Fisheries in 1901, but notes that other species, including pumpkinseed, may have accompanied these fish. Nonetheless, that only three Vancouver Island Region lakes were historically stocked by government agencies while confirmed and unconfirmed records for smallmouth bass are distributed across 20 separate drainages suggests most populations originated through independent, unauthorized introductions.

Physical attributes of Vancouver and Gulf Islands lakes containing smallmouth bass are detailed in Table 20. Based on available data, smallmouth bass may occupy over 244 km of lake perimeter, over 8,000 ha of lake surface area and over 700 ha of lake littoral area in the Vancouver Island Region.

Physical attributes of Vancouver and Gulf Islands streams containing smallmouth bass are detailed in Table 21. Without detailed stream mapping, as was

completed for yellow perch but precluded for other species due to time and resource constraints, it was not possible to estimate the length of stream currently occupied by this species in the Vancouver Island Region.

Vancouver and Gulf Islands lakes and streams containing confirmed and unconfirmed populations of smallmouth bass support a variety of native and other non-native species including anadromous and resident bull trout, anadromous and resident cutthroat trout, Atlantic salmon, burbot, western brook lamprey, brown catfish, coastrange sculpin, prickly sculpin, chinook, chum, coho and pink salmon, Dolly Varden, eastern brook trout, brown trout, kokanee, lake lamprey, largemouth bass, lake whitefish, peamouth chub, Pacific lamprey, pumpkinseed, rainbow trout, starry flounder, steelhead, threespine stickleback and yellow perch. These species vary widely in presence and abundance among individual lakes and streams. However, 3 of 53 waterbodies containing confirmed or unconfirmed populations of smallmouth bass provide habitat for salmon, while an additional 40 are connected by surface waters to downstream salmon populations (Table 22). All waterbodies containing confirmed or unconfirmed smallmouth bass populations contain native sportfish or other native species, though only 50 of 53 provide downstream connectivity native sportfish or other native fish. Twenty-seven of 53 lake and stream systems containing confirmed or unconfirmed populations of smallmouth bass also contain other non-native spiny-rayed fish species.

Lower Mainland Region (Lower Fraser River Watershed)

Smallmouth bass presence has been confirmed for Kawkawa Lake and the Salmon River in the lower Fraser River watershed (see Table 23). The general location of these occurrence records is illustrated in Figure 9. Though the frequency and condition of outlet flows from Kawkawa Lake is unknown, this waterbody is geographically isolated from the Salmon River, potentially linked only by shared receiving waters of the Fraser River.

First observation dates for Salmon River and Kawkawa Lake smallmouth bass are relatively recent, in 2000 and 2003, respectively (Tracy Cone, DFO Area, pers. comm.; Justin Peterson, Angler, pers. comm., cited in Hatfield and Pollard 2006). Neither population originated through authorized stocking activities (Erin Stoddard, BC MOE Regional Biologist, pers. comm.). This, together with the lack of direct physical connectivity between these waterbodies, suggests that their smallmouth bass populations originated through independent unauthorized introductions. Only a single capture of smallmouth bass has been reported for Kawkawa Lake, this individual weighing approximately 1.4 kg (Erin Stoddard, BC MOE Regional Biologist, pers. comm.). The lack of subsequent captures in this system may indicate a failed introduction attempt (Erin Stoddard, BC MOE Regional Biologist, pers. comm.).

Physical attributes of Kawkawa Lake are detailed in Table 24. Based on available data, smallmouth bass may occupy approximately 4.1 km of lake

perimeter, over 77 ha of lake surface area and over 11 ha of lake littoral area in the lower Fraser River watershed.

Physical attributes of the Salmon River are detailed in Table 25. In the absence of detailed stream mapping, it was not possible to estimate the length of stream currently occupied by smallmouth bass in the Lower Mainland Region.

Kawkawa Lake and the Salmon River support a diverse array of native and other non-native species including anadromous and resident cutthroat trout, brassy minnow, coastrange, prickly and slimy sculpin, chinook, coho, chum, pink and sockeye salmon, largescale sucker, Dolly Varden, goldfish, kokanee, lamprey, lake chub, largemouth bass, Nooksack dace, northern pikeminnow, peamouth chub, pumpkinseed, rainbow trout, redside shiner, starry flounder, Salish sucker, steelhead and threespine stickleback, varying in presence and abundance between systems. Both waterbodies provide habitat for salmon, native sportfish and other native species as well as connectivity to downstream populations (Table 22). However, only the Salmon River contains other non-native spiny-rayed fish species, including pumpkinseed and largemouth bass.

Thompson Region (South Thompson River Watershed)

Two lake occurrence records for smallmouth bass were recorded in the South Thompson River watershed, one confirmed and the other unconfirmed (see Table 26 and Figure 9). As one of these waterbodies, Phillips Lake, lacks a surface water connection to Shuswap Lake and the South Thompson River these are independent occurrences.

The first recorded occurrence of smallmouth bass in the South Thompson River watershed was in Phillips Lake in 1999 (Steve Maricle, BC MOE Regional Biologist, pers. comm.; Ken Tsumura, pers. comm., cited in Hatfield and Pollard 2006). However, no local or downstream captures have since been recorded for this waterbody, suggesting a failed introduction or erroneous species identification (Steve Maricle, BC MOE Regional Biologist, pers. comm.). Smallmouth bass have been recently confirmed in Gardom Lake, where a gravel outlet filter was constructed by the BC MOE in 2007 to prevent downstream movement of spiny-rayed fish species during seasonal outflows (Steve Maricle, BC MOE Regional Biologist, pers. comm.). No authorized stocking of smallmouth bass has been undertaken in the Thompson Region (Steve Maricle, BC MOE Regional Biologist, pers. comm.). This, together with the physical isolation of Phillips and Gardom Lakes, suggests their smallmouth bass populations originated through independent, unauthorized introductions.

Physical attributes of Thompson Region lakes containing smallmouth bass are detailed in Table 27. Based on available data, smallmouth bass may occupy over 8 km of lake perimeter, nearly 132 ha of lake surface area and over 31 ha of lake littoral area.

The two South Thompson River watershed lakes containing smallmouth bass are both headwater systems, supporting a number of native and other non-native species including eastern brook trout, lake chub, rainbow trout, largemouth bass, pumpkinseed and yellow perch. Additional occurrence records of cutthroat trout, coastrange sculpin and lake trout are likely in error (Dave Pehl, MOE Regional Biologist, pers. comm.). Both systems have been found to contain other non-native spiny-rayed fish species, including smallmouth bass, pumpkinseed and yellow perch. Though both waterbodies are connected to downstream native sportfish and other native species, only Gardom Lake is connected, albeit seasonally, to downstream habitat for anadromous salmon (Table 22).

Kootenay Region (Upper Columbia River (Kootenay) Watershed)

Smallmouth bass presence has been confirmed for two streams in the Kootenay watershed and remains unconfirmed for one additional stream (see Table 28). All occurrence records for smallmouth bass in the Kootenay Region are from the international trans-boundary area near Castlegar, BC, where the mainstem Pend D'Oreille and Columbia Rivers provide avenues of introduction and dispersal for established smallmouth bass populations in the United States (Jeff Burrows, MOE Regional Biologist, pers. comm.; see Figure 9).

The first recorded occurrence of smallmouth bass in the Kootenay watershed was in the Pend D'Oreille River in 1956 (Ken Tsumura, pers. comm., cited in Hatfield and Pollard 2006), likely originating through dispersal from trans-boundary headwaters of the Pend D'Oreille River or trans-boundary receiving waters of the Columbia River where they were known to occur (Jeff Burrows, MOE Regional Biologist, pers. comm.). Though recognized as present, the current status of smallmouth bass in the Kootenay Region is unknown due to their limited distribution and occurrence within already diverse fish communities (Jeff Burrows, MOE Regional Biologist, pers. comm.).

Provincial records contain no accounts of authorized smallmouth bass stocking in the Kootenay watershed. However, Fraser and Moyie Lakes were stocked with "Bass/Sunfish (General)" during the period of 1901 through 1923 (see Table 29). Of these waterbodies, only Fraser Lake is known to support a spiny-rayed fish species - largemouth bass - to the present day (John Bell, MOE Regional Biologist, pers. comm.).

Physical attributes of Kootenay Region streams containing smallmouth bass are detailed in Table 30. In the absence of detailed stream mapping, it was not possible to estimate the length of stream currently occupied by smallmouth bass in this area of the province.

Kootenay watershed streams containing confirmed or unconfirmed populations of smallmouth bass support a diverse array of native and other non-native species including burbot, black crappie, brown catfish, bridgelip sucker, bull trout, prickly sculpin, mottled sculpin, slimy sculpin, shorthead sculpin, chiselmouth, carp,

torrent sculpin, largescale sucker, cutthroat trout, eastern brook trout, brown trout, Arctic grayling, kokanee, leopard dace, lake chub, largemouth bass, longnose dace, longnose sucker, lake trout, lake whitefish, northern mountain sucker, mountain whitefish, northern pikeminnow, peamouth chub, pumpkinseed, pygmy whitefish, rainbow trout, redside shiner, tench, Umatilla dace, walleye, white sturgeon and yellow perch. As in other regions, the presence and abundance of these species varies widely among individual lakes and streams.

All three Kootenay Region waterbodies containing confirmed or unconfirmed occurrences of smallmouth bass provide local habitat and downstream connectivity to receiving waters containing native sportfish and other native species (Table 22). Confirmed and unconfirmed occurrences of other spiny-rayed fish species have also been recorded for all three waterbodies containing smallmouth bass. Migratory salmon are presently absent from the Kootenay watershed due to obstructions posed by a succession of downstream hydroelectric dams. Upstream dams presently contain smallmouth bass within the trans-boundary area noted above. However, a lock in the Hugh Keenlyside Dam at Castlegar, BC, provides for vessel passage into Lower Arrow Lake. Utilized up to 10 times per day for industrial vessels and as many as 40 times per year for pleasure craft (Dean den Biesen, BC Hydro Environmental Technical Specialist, pers. comm.), this lock may ultimately facilitate movement of smallmouth bass into upstream waters of the Columbia River mainstem.

Okanagan Region (Lower Columbia River (Okanagan) Watershed)

Smallmouth bass presence has been confirmed for 10 waterbodies in the Okanagan watershed, including 7 lakes and 3 streams (see Table 31). The distribution of smallmouth bass occurrences in this region is limited to trans-boundary areas of the Okanagan River and Kettle River drainages (see Figure 9).

In the Okanagan River drainage, smallmouth bass are present in mainstem lake and river sections downstream of Okanagan Lake. In addition, smallmouth bass occupy three valley bottom lakes adjacent to the Okanagan River channel and Osoyoos Lake. In the Kettle River drainage, this species is present in the mainstem Kettle River below Cascade Falls and in Christina Lake and its outlet Christina Creek (Brian Jantz, MOE Regional Biologist, pers. comm.). As for yellow perch, mainstem river and lake sections provide a broader and more contiguous distribution for Okanagan Region smallmouth bass than is seen elsewhere in BC.

The first recorded occurrence of smallmouth bass in the Okanagan watershed identified by Hatfield and Pollard (2006) was in Christina Lake in 1944 (Unknown 1944, cited in Hatfield and Pollard 2006). The most recent regional occurrence for this species was in Deadman Lake in 1987 (BC MOELP 1995a, cited in Hatfield and Pollard 2006). No smallmouth bass populations in the Okanagan River system originated through authorized stocking activities within Canada

(Brian Jantz, BC MOE Regional Biologist, pers. comm.). However, Christina Lake was stocked with 500 "Bass/Sunfish (General)" fry in 1901 (see Table 32). As this waterbody presently contains smallmouth bass, largemouth bass and pumpkinseed, it is difficult to determine which species was historically stocked. Dymond (1936) refers to stocking of smallmouth bass in Christina Lake by the federal Department of Fisheries in 1901, but notes that pumpkinseed may have accompanied these fish. In addition, smallmouth bass were transferred from Christina Lake to supplement pre-existing populations Vaseux Lake and Skaha Lake in 1987 and 1988 (BC MOELP 1995b,c).

It is possible that smallmouth bass in the Okanagan River downstream of Skaha Lake and in the Kettle River may been established through one or more unauthorized introductions, through dispersal of fish historically introduced into Christina Lake or through trans-boundary dispersal from established populations in the US. However, as a mainstem flow control dam at McIntyre Bluff currently limits upstream fish movement in the Okanagan River to a point below Vaseux Lake, and a natural obstruction at Okanagan Falls historically limited upstream fish movement to a point below Skaha Lake, smallmouth bass in Skaha Lake were necessarily established through one or more unauthorized introductions (Brian Jantz, BC MOE Regional Biologist, pers. comm.). Dependent on outlet conditions, smallmouth bass in Peanut, Deadman and Tugulnuit Lakes may have become established through dispersal of Okanagan River mainstem populations, unauthorized introductions or some combination thereof.

Physical attributes of Okanagan Region lakes containing smallmouth bass are detailed in Table 33. Based on available data, smallmouth bass may occupy over 137 km of lake perimeter, over 7,000 ha of lake surface area and over 392 ha of lake littoral area within the Okanagan watershed. Physical attributes of Okanagan Region streams containing smallmouth bass are detailed in Table 34. In the absence of detailed stream mapping, it was not possible to estimate the length of stream currently occupied by smallmouth bass in this area of the province. However, based on the ecology of the species and local habitat conditions, smallmouth bass are likely present throughout mainstem lake and river sections downstream of Okanagan Lake as well as connected valley bottom lakes and streams (Brian Jantz, BC MOE Regional Biologist, pers. comm.).

Okanagan watershed lakes and streams containing confirmed or unconfirmed populations of smallmouth bass support a diverse array of native and other non-native species including burbot, black crappie, black catfish, brown catfish, bull trout, cutthroat trout, prickly sculpin, mottled sculpin, slimy sculpin, shorthead sculpin, chinook salmon, chiselmouth, carp, largescale sucker, eastern brook trout, brown trout, goldfish, kokanee, leopard dace, largemouth bass, longnose dace, longnose sucker, lake trout, lake whitefish, mountain whitefish, northern pikeminnow, peamouth chub, pumpkinseed, pygmy whitefish, rainbow trout, redside shiner, speckled dace, sockeye salmon, steelhead, tench, Umatilla dace, walleye and yellow perch. As in other regions, the presence and abundance of these species varies widely among individual lakes and streams. Of waterbodies

containing confirmed or unconfirmed populations of smallmouth bass, only Osoyoos Lake and the Okanagan River normally provide habitat for migratory salmon (Table 22). However, an ongoing experimental outplant of sockeye salmon fry above low head dams on the Okanagan River into Skaha Lake presently provides this species with access to Skaha and Vaseux Lakes. All ten confirmed smallmouth bass waterbodies also support native sportfish or other native species and at least seven are connected by surface waters to downstream areas supporting both salmon and native species. Eight of ten lake and stream systems containing confirmed populations of smallmouth bass also contain other non-native spiny-rayed fish species.

Cariboo Region (Middle Fraser River Watershed)

Following an angler-reported occurrence of smallmouth bass in July 2006, BC MOE staff confirmed this species to be present in four mainstem lakes and the mainstem channel of Beaver Creek, a tributary of the Quesnel River north of Williams Lake, BC (see Table 35 and Figure 9). Based on the lack of historic stocking of bass species by government agencies in the middle Fraser River watershed and the geographic isolation of these confirmed occurrences from other known smallmouth bass populations in BC, it seems certain that they were established through one or more local, unauthorized introductions (Tom Wilkinson, BC MOE Regional Biologist, pers. comm.).

Physical attributes of Cariboo Region lakes containing smallmouth bass are detailed in Table 36. Based on available data, smallmouth bass may occupy over 34 km of lake perimeter, over 476 ha of lake surface area and over 273 ha of lake littoral area within the middle Fraser River watershed. Physical attributes of Cariboo Region streams containing smallmouth bass are detailed in Table 37. Based on available data, smallmouth bass may also occupy nearly 56 km of stream length in this area of the Province.

Lakes and streams of the Beaver Creek system support a variety native fish species including bridgelip sucker, burbot, chinook salmon, kokanee, lake whitefish, longnose sucker, mountain whitefish, northern pikeminnow, peamouth chub, pink salmon, rainbow trout, redside shiner, sockeye salmon and white sucker. Though physical obstructions limit migratory salmon to the lower mainstem of Beaver Creek, all confirmed smallmouth bass waterbodies in this drainage directly provide and are connected to downstream waters that provide habitat for native sportfish and other native species (Table 22). No other spiny-rayed fish species are present in the middle Fraser River watershed.

LARGEMOUTH BASS

Current Distribution in BC

Largemouth bass presence was confirmed for 92 waterbodies in BC, including 49 lakes or ponds and 43 streams. Unconfirmed occurrences of largemouth bass

were recorded for an additional eight lakes and five streams. The distribution of these records across the Province is illustrated in Figure 10.

Confirmed and unconfirmed records of largemouth bass presence are distributed across five regional fisheries management areas of the BC MOE. Names and tributary relationships for confirmed and unconfirmed records of largemouth bass within the broad geographic regions of their provincial range are detailed in Tables 38, 41, 44, 46 and 49, below. A brief account of local largemouth bass distributions within these regions, including timing and mode of introduction and presence of other fish species with which largemouth bass may interact, are provided below.

Distribution, Timing and Mode of Invasion and Spread

Though locally extensive in low gradient, complex drainages of the Lower Mainland and Kootenay Regions, the present distribution of largemouth bass within BC is otherwise characteristic of other non-native spiny-rayed species, broadly comprised of geographically, physically and/or hydrologically isolated individual lakes or small lake groups and associated inlet and outlet streams. Again, large mainstem lakes and rivers (e.g. Osoyoos Lake and Okanagan River) and international trans-boundary systems (e.g. Kootenay River and Sumas River) that provide favourable habitat for this species are exceptions to the pattern and may have served as avenues of introduction and dispersal.

Vancouver Island Region (Vancouver and Gulf Islands)

Three lake-based occurrence records for largemouth bass were identified on Vancouver Island, two confirmed and one unconfirmed (see Table 38 and Figure 10). Based on provincial watershed coding, these records are located in separate drainages, linked only by marine or estuarine waters.

First observation dates are not recorded for largemouth bass occurrences on Vancouver Island. However, provincial records contain no accounts of authorized largemouth bass stocking in the Vancouver Island Region. Also, generic "Bass/Sunfish (General)" stocking records for this region do not include any of the waterbodies where largemouth bass have been reported. Together with the physical isolation of Elk, Prospect and Fuller lakes, this suggests their largemouth bass populations originated through independent, unauthorized introductions.

Physical attributes of Vancouver Island Region lakes containing largemouth bass are detailed in Table 39. Based on available data, largemouth bass may occupy over 16.5 km of lake perimeter, approximately 300 ha of lake surface area and over 147 ha of lake littoral area.

The three Vancouver Island lakes containing largemouth bass are headwater systems, supporting a number of native and non-native species including black

and brown catfish, cutthroat trout, prickly sculpin, pumpkinseed, rainbow trout, smallmouth bass, threespine stickleback and yellow perch, varying in presence and abundance between systems. Though none of these waterbodies provide direct habitat for migratory salmon, all are connected to salmon-bearing waters downstream (see Table 40). All three systems have been found to contain native sportfish and other native species and are connected to additional populations downstream. All three waterbodies also contain other non-native spiny-rayed fish species, including smallmouth bass, pumpkinseed and yellow perch.

Lower Mainland Region (Lower Fraser River Watershed)

Largemouth bass presence was confirmed for 50 waterbodies in the lower Fraser River watershed, including 16 lakes and 34 streams (see Table 41). Based on provincial watershed coding, these records are distributed across 20 drainages. Though not all waterbodies containing largemouth bass may possess downstream connectivity due to physical or hydrologic isolation, 15 of 20 drainages are potentially linked by shared receiving waters of the Fraser River while the remaining 5 drainages are potentially linked only by marine or estuarine waters.

The first recorded occurrence of largemouth bass in the Lower Mainland Region was in 1987 in Judson Lake (Anonymous, West Coast Bass Anglers, pers. comm., cited in Hatfield and Pollard 2006). The most recent occurrences for this species were in 2004 when 14 records were confirmed over seven separate drainages (Anonymous, MOE Region, pers. comm.; Chad Keogh, West Coat Bass Anglers, pers. comm.; Maurice Coultier-Boisvert, DFO Area, pers. comm.; Anonymous, fisheries consultant, pers. comm.; Jim Taylor, Stave Valley Salmonid Enhancement Society, pers. comm.; Pearson 1998, all cited in Hatfield and Pollard 2006). Provincial records contain no accounts of authorized largemouth bass stocking in the Lower Mainland Region. That confirmed records for this species are distributed across 20 separate drainages suggests many populations originated through independent, unauthorized introductions followed by localized dispersal. McPhail (2007) states that largemouth bass dispersal into Lower Mainland Region occurred via the trans-boundary Sumas River system while local advocates for promotion and conservation of bass angling opportunities have advised government biologists of their belief that largemouth bass are naturally recruiting into waterbodies in the lower Fraser River watershed from long-established upstream sources on the Fraser River floodplain (Anonymous, West Coast Bass Anglers, pers. comm., cited in Hatfield and Pollard 2006).

Physical attributes of lower Fraser River watershed lakes containing largemouth bass are detailed in Table 42. Based on available data, largemouth bass may occupy over 21 km of lake perimeter, nearly 28,000 ha of lake surface area and over 111 ha of lake littoral area in the Lower Mainland Region.

Physical attributes of lower Fraser River watershed streams containing largemouth bass are detailed in Table 43. Without detailed stream mapping, as was completed for yellow perch but precluded for other species due to time and resource constraints, it was not possible to estimate the length of stream currently occupied by this species in the Lower Mainland Region.

Lower Fraser River watershed lakes and streams containing populations of largemouth bass support a variety of native and other non-native species including anadromous and coastal cutthroat trout, Atlantic salmon, burbot, black crappie, brassy minnow, brown catfish, bridgelip, largescale, longnose, mountain, Salish and white sucker, bull trout, coastrange, prickly, slimy and staghorn sculpin, chinook, chum, coho, pink and sockeye salmon, chiselmouth, carp, Dolly Varden, eastern brook trout, emerald shiner, eulachon, goldfish, green sturgeon, kokanee, leopard and Nooksack dace, lake and peamouth chub, longnose dace, longfin, pygmy longfin and surf smelt, northern pikeminnow, Pacific and river lamprey, pumpkinseed, pygmy whitefish, rainbow trout, redside and spotfin shiner, starry flounder, American shad, smallmouth bass, summer and winter-run steelhead, threespine stickleback and white sturgeon. These species vary widely in presence and abundance among individual lakes and streams. However, 31 of 50 waterbodies containing populations of largemouth bass provide habitat for salmon, while an additional 12 are connected by surface waters to downstream salmon populations (Table 40). Thirty-six waterbodies containing confirmed or unconfirmed largemouth bass populations contain native sportfish or other native species and an additional eight provide downstream connectivity native sportfish or other native fish. Ten of 50 lake and stream systems containing largemouth bass also contain other non-native spiny-rayed fish species.

Thompson Region (South Thompson River Watershed)

A single, confirmed occurrence of largemouth bass was identified in the South Thompson River watershed (see Table 44 and Figure 10). Largemouth bass were first observed in Phillips lake in 1999 (Stacy Webb, MOE Regional Biologist, pers. comm., cited in Hatfield and Pollard 2006). Though this waterbody does have a seasonal outlet channel, no downstream captures of largemouth bass have been recorded (Steve Maricle, BC MOE Regional Biologist, pers. comm.). Provincial records contain no accounts of authorized largemouth bass stocking in the South Thompson River watershed, suggesting that the largemouth bass of Phillips Lake originated through one or more unauthorized introductions.

Physical attributes of Phillips Lake are detailed in Table 45. Based on available data, largemouth bass may occupy approximately 4 km of lake perimeter and 56 ha of lake surface area in the Thompson Region.

In addition to largemouth bass, Phillips Lake supports eastern brook trout, lake chub, rainbow trout, smallmouth bass, pumpkinseed and yellow perch. A recorded occurrence of cutthroat trout in this waterbody is likely in error (Dave

Pehl, MOE Regional Biologist, pers. comm.). Though seasonally connected to downstream native sportfish and other native species, the Phillips Lake drainage is isolated from downstream salmon habitat.

Kootenay Region (Upper Columbia River (Kootenay) Watershed)

Largemouth bass presence has been confirmed for 31 waterbodies in the Kootenay watershed, including 24 lakes and seven streams (see Table 46 and Figure 10). A further 11 unconfirmed occurrence reports for largemouth bass have been recorded, including six lakes and five streams. Based on provincial watershed coding and local knowledge, confirmed and unconfirmed occurrence records for this are distributed across 21 separate drainages. However, this number may be substantially reduced if confirmed and unconfirmed occurrence records for largemouth bass were extrapolated to downstream areas based on the species' ecology and local knowledge of BC MOE fisheries staff species as was done for yellow perch. In particular, clustered point occurrence records for largemouth bass in headwater lakes of the Columbia River, the extensive lake- and stream-based wetlands of the Creston Wildlife Management Area and lakes and streams of the Elk, Bull and St Mary River watersheds are likely to be linked by shared receiving waters of the upper Columbia River, Kootenay River and Lake Koocanusa, respectively. In conjunction with the stocking activities described below, unauthorized introductions and local dispersal, the international trans-boundary waters of the Kootenay River and Lake Koocanusa may have facilitated movement of largemouth bass into Canada from established populations in the United States (McPhail 2007; Dymond 1936).

The first recorded occurrence of largemouth bass in the Kootenay watershed identified by Hatfield and Pollard (2006) was in Wasa Lake in 1956 (Maher 1956, cited in Hatfield and Pollard 2006). However, Dymond (1936) records this species as being present in Kootenay Lake as early as 1921. The most recent new occurrence for this species was in Windermere Lake in 1994 (Griffith 1994, cited in Hatfield and Pollard 2006). Provincial records contain no accounts of authorized largemouth bass stocking in the Kootenay watershed. However, Fraser and Moyie Lakes were stocked with "Bass/Sunfish (General)" during the period of 1901 through 1923 (see Table 29). Of these waterbodies, only Fraser Lake is known to support largemouth bass to the present day (John Bell, MOE Regional Biologist, pers. comm.).

Physical attributes of Kootenay Region lakes are detailed in Table 47. Based on available data, largemouth bass may occupy over 456 km of lake perimeter, over 46,403 ha of lake surface area and over 1,698 ha of lake littoral area in the Kootenay Region. Physical attributes of Kootenay Region streams containing largemouth bass are detailed in Table 48. In the absence of the detailed stream mapping noted above, it was not possible to estimate the length of stream currently occupied by largemouth bass in this area of the province.

Kootenay watershed streams containing confirmed or unconfirmed populations of largemouth bass support a diverse array of native and other non-native species including Arctic and Montana grayling, black catfish, bridgelip sucker, brown trout, bull trout, burbot, carp, chiselmouth, cutthroat trout, eastern brook trout, kokanee, lake chub, lake trout, lake whitefish, largescale sucker, leopard dace, longnose dace, longnose sucker, mottled sculpin, mountain whitefish, northern mountain sucker, northern pikeminnow, peamouth chub, prickly sculpin, pumpkinseed, pygmy whitefish, rainbow trout, redside shiner, shorthead sculpin, slimy sculpin, smallmouth bass, torrent sculpin, Umatilla dace, walleye, white sturgeon and yellow perch. Given the distance from its known BC range, an additional occurrence record of threespine stickleback in Wasa Lake is likely in error. As in other regions, the presence and abundance of these species varies widely among individual lakes and streams.

Thirty-four waterbodies containing confirmed or unconfirmed largemouth bass populations contain native sportfish or other native species while 27 provide downstream connectivity to native sportfish or other native fish populations (see Table 40). Twenty-seven of 42 lake and stream systems containing largemouth bass also contain other non-native spiny-rayed fish species. Migratory salmon are presently absent from the Kootenay watershed due to obstructions posed by a succession of downstream hydroelectric dams.

Okanagan Region (Lower Columbia River (Okanagan) Watershed)

Eight waterbodies in the Okanagan watershed contain confirmed populations of largemouth bass, including six lakes and two streams (see Table 49 and Figure 10). An unconfirmed largemouth bass occurrence was recorded for one additional lake. Three of nine largemouth bass occurrence records in the Okanagan Region are headwater (i.e., Trout and Yellow lakes) or isolated lakes (i.e., Shannon Lake), as is commonly observed for this species in the Vancouver Island and Thompson Regions. The remaining records consist of larger, mainstem streams (i.e. Okanagan River and Christina Creek) and associated mainstem lakes which provide a broader and more contiguous species distribution, in common with the Kootenay and Lower Mainland Regions.

The first recorded occurrence of largemouth bass in the Okanagan watershed identified by Hatfield and Pollard (2006) was in 1944 in Christina Lake (Unknown 1944, cited in Hatfield and Pollard 2006). The most recent new occurrence recorded for this species was in Vaseux Lake in 1967 (Balkwill 1967, cited in Hatfield and Pollard 2006). However, Dymond (1936) records largemouth bass as being present in Osoyoos and Vaseux lakes as early as 1928 while Field and Dickie (1987) report the capture of largemouth bass in Vaseux Lake as early as 1909.

No largemouth bass populations in the Okanagan Region originated through authorized stocking activities within Canada (Brian Jantz, BC MOE Regional Biologist, pers. comm.). However, Christina Lake was stocked with 500

"Bass/Sunfish (General)" fry in 1901 (see Table 32). As this waterbody presently contains smallmouth bass, largemouth bass and pumpkinseed, it is difficult to determine which species was historically stocked. Largemouth bass in Osoyoos Lake - an international trans-boundary waterbody - may have dispersed into Canada from the US (Dymond 1936). Such movements may have also resulted in largemouth bass presence in unobstructed contiguous waters. Unauthorized headwater lake introductions followed by downstream dispersal may have resulted in largemouth bass becoming established in mainstem lakes of the Okanagan River system upstream of historical and current fish passage obstructions (e.g. Skaha and Vaseux lakes, respectively). Excepting these incidents of possible trans-boundary and downstream dispersal, largemouth bass populations in the Okanagan Region are thought to have originated through unauthorized introductions (Brian Jantz, BC MOE Regional Biologist, pers. comm.). Based on the ecology of the species and local habitat conditions, largemouth bass are likely present throughout mainstem lake and river sections downstream of Okanagan Lake (Brian Jantz, BC MOE Regional Biologist, pers. comm.).

Physical attributes of Okanagan Region lakes containing largemouth bass are detailed in Table 50 Based on available data, largemouth bass may occupy over 140 km of lake perimeter, nearly 7,100 ha of lake surface area and approximately 392 ha of lake littoral area within the Okanagan watershed. Physical attributes of Okanagan Region streams containing largemouth bass are detailed in Table 51. In the absence of detailed stream mapping, it was not possible to estimate the length of stream currently occupied by largemouth bass in this area of the province.

Okanagan watershed lakes and streams containing confirmed or unconfirmed populations of largemouth bass support a wide range of native and other non-native species including burbot, black crappie, black and brown catfish, eastern brook trout, prickly sculpin, carp, chinook salmon, chiselmouth, goldfish, kokanee, lake whitefish, largemouth bass, longnose sucker, mottled sculpin, largescale sucker, mountain whitefish, northern pikeminnow, peamouth chub, pumpkinseed, rainbow trout, redside shiner, smallmouth bass, sockeye salmon, steelhead, tench, walleye and yellow perch. As in other regions, the presence and abundance of these species varies widely among individual lakes and streams. Of waterbodies containing confirmed or unconfirmed populations of largemouth bass, only Osoyoos Lake and the Okanagan River presently provide habitat for migratory salmon. However, an ongoing experimental outplant of sockeye salmon fry above low head dams on the Okanagan River into Skaha Lake presently provides this species with access to Skaha and Vaseux lakes (Table 40). Eight of nine confirmed or unconfirmed largemouth bass waterbodies also support native sportfish or other native species. Six Okanagan Region waterbodies containing largemouth bass are directly connected by surface waters to downstream areas supporting migratory salmon, resident sportfish and other native species. All lake and stream systems containing confirmed or

unconfirmed populations of largemouth bass also contain other non-native spiny-rayed fish species.

PUMPKINSEED

Current Distribution in BC

Pumpkinseed presence was confirmed for 104 waterbodies in BC, including 50 lakes or ponds and 54 streams. Unconfirmed occurrences of pumpkinseed were recorded for an additional 4 lakes and 5 streams. The distribution of these records across the Province is illustrated in Figure 11.

Confirmed and unconfirmed records of pumpkinseed presence are distributed across 5 regional fisheries management areas of the BC MOE. Names and tributary relationships for confirmed and unconfirmed records of pumpkinseed within the broad geographic regions of their provincial range are detailed in Tables 52, 56, 59, 61 and 64, below. A brief account of local pumpkinseed distributions within these regions, including timing and mode of introduction and presence of other fish species with which pumpkinseed may interact, are provided below.

Distribution, Timing and Mode of Invasion and Spread

In low gradient, complex drainages of the Vancouver Island and Lower Mainland Regions and large mainstem lakes and rivers of the Okanagan Region, pumpkinseed are among the more widespread non-native spiny-rayed fish species (see Figure 11). In other BC regions, pumpkinseed distributions are more characteristic of other species of concern, occupying geographically, physically and/or hydrologically isolated individual lakes or small lake groups and associated inlet and outlet streams.

Vancouver Island Region (Vancouver and Gulf Islands)

Pumpkinseed presence was confirmed for 55 waterbodies on Vancouver Island, including 29 lakes and 26 streams (see Table 52). Based on provincial watershed coding, confirmed occurrence records for this species are distributed across 21 separate drainages, linked only by marine or estuarine waters.

The first recorded occurrence of pumpkinseed in the Vancouver Island Region was in 1953 in Swan Lake (Vernon 1953, cited in Hatfield and Pollard 2006). The most recent occurrence for this species was in Cat Stream Creek in 2000 (Thirkill 2000, cited in Hatfield and Pollard 2006). Provincial records contain no accounts of authorized pumpkinseed stocking on Vancouver Island. However, three island waterbodies, Spider, Langford and Florence lakes, were stocked with "Bass/Sunfish (General)" during the period of 1901 through 1923 (see Table 19). Though pumpkinseed have not yet been reported in Spider Lake, Langford and Florence lakes contain both pumpkinseed and smallmouth bass.

Thus, it is difficult to determine which species was historically stocked. That only three Vancouver Island Region lakes were historically stocked by government agencies while confirmed and unconfirmed records for pumpkinseed are distributed across 21 separate drainages suggests most populations originated through independent, unauthorized introductions. However, BC MOE Regional Biologists have reported this species to readily spread once established - being very mobile and seemingly capable of navigating upstream in turbulent water - and suggest that they are likely present in all accessible waters of affected watersheds below 200 m elevation (Trevor Andrews BC MOE Regional Biologist, pers. comm.).

Physical attributes of Vancouver Island lakes containing pumpkinseed are detailed in Table 53. Based on available data, pumpkinseed may occupy over 291 km of lake perimeter, nearly 10,348 ha of lake surface area and approximately 497 ha of lake littoral area in the Vancouver Island Region.

Physical attributes of Vancouver Island streams containing pumpkinseed are detailed in Table 54. Without detailed stream mapping, as was completed for yellow perch but precluded for other species due to time and resource constraints, it was not possible to estimate the length of stream currently occupied by this species in the Vancouver Island Region.

Vancouver Island lakes and streams containing confirmed populations of pumpkinseed support a variety of native and other non-native species including anadromous and resident cutthroat trout, Atlantic salmon, brown and black catfish, bull trout, coastrange and prickly sculpin, chinook, chum, coho, pink and sockeye salmon, eastern brook trout, brown trout, kokanee, lake whitefish, peamouth chub, Pacific and river lamprey, rainbow trout, largemouth and smallmouth bass, steelhead, threespine stickleback and yellow perch. These species vary widely in presence and abundance among individual lakes and streams. However, 36 of 55 waterbodies containing confirmed populations of pumpkinseed provide habitat for salmon, while an additional 15 are connected by surface waters to downstream salmon populations (Table 55). All but one waterbody containing confirmed pumpkinseed populations contain native sportfish or other native species and provide downstream connectivity to similar populations. Twenty-six of 55 lake and stream systems containing confirmed populations of pumpkinseed also contain other non-native spiny-rayed fish species.

Lower Mainland Region (Lower Fraser River Watershed)

Pumpkinseed presence was confirmed for 26 waterbodies in the lower Fraser River watershed, including six lakes and 20 streams (see Table 56). Two unconfirmed stream-based occurrence reports for pumpkinseed were also identified. Based on provincial watershed coding, these records are distributed across 17 separate drainages. Though not all waterbodies containing pumpkinseed may possess downstream connectivity due to physical or

hydrologic isolation, 11 of 17 drainages are potentially linked by shared receiving waters in the Fraser River while the remaining six drainages are potentially linked only by marine or estuarine waters.

The first recorded occurrence of pumpkinseed in the Lower Mainland Region was in Chilliwack Creek in 1975 (Scott Resource Services Inc. No date., cited in Hatfield and Pollard 2006). The most recent recorded occurrence for this species was in Crescent Slough in 2004 (Coast River Environmental Services Ltd. No date., cited in Hatfield and Pollard 2006). Provincial records contain no accounts of authorized pumpkinseed stocking in the Lower Mainland Region. That confirmed records for this species are distributed across 17 separate drainages suggests many populations originated through independent, unauthorized introductions followed by localized dispersal. However, based on the species' ecology and local knowledge, BC MOE fisheries managers expect pumpkinseed are present in all connected waters downstream of confirmed occurrence records (Erin Stoddard, BC MOE Regional Biologist, pers. comm.).

Physical attributes of lower Fraser River watershed lakes containing pumpkinseed are detailed in Table 57. Based on available data, pumpkinseed may occupy over 3.4 km of lake perimeter, over 5,400 ha of lake surface area and approximately 6.2 ha of lake littoral area in the Lower Mainland Region.

Physical attributes of lower Fraser River watershed streams containing pumpkinseed are detailed in Table 58. Without detailed stream mapping it was not possible to estimate the length of stream currently occupied by this species in the Lower Mainland Region.

Lower Fraser River watershed lakes and streams containing populations of pumpkinseed support a variety of native and other non-native species including anadromous and coastal cutthroat trout, black catfish, black crappie, brassy minnow, brown catfish, carp, chinook salmon, chum salmon, coastrange sculpin, coho salmon, Dolly Varden, eastern brook trout, eulachon, fathead minnow, flathead chub, goldfish, kokanee, lake whitefish, largemouth bass, largescale sucker, longfin smelt, longnose dace, longnose sucker, mountain whitefish, Nooksack dace, northern pikeminnow, peamouth chub, pink salmon, prickly sculpin, pygmy longfin smelt, rainbow trout, redside shiner, Salish sucker, slimy sculpin, smallmouth bass, sockeye salmon, splake, starry flounder, steelhead, surf smelt, threespine stickleback, western brook lamprey and white sturgeon. These species vary widely in presence and abundance among individual lakes and streams. However, 22 of 28 waterbodies containing populations of pumpkinseed provide habitat for salmon, while all are connected by surface waters to downstream salmon populations (Table 55). Twenty-six waterbodies containing confirmed or unconfirmed pumpkinseed populations contain native sportfish or other native species and all provide downstream connectivity to similar communities. Ten of 28 lake and stream systems containing pumpkinseed also contain other non-native spiny-rayed fish species.

Thompson Region (South Thompson River Watershed)

Pumpkinseed have been recorded in a single, isolated three-lake drainage in the Thompson Region (see Table 59). Confirmed in uppermost Phillips Lake in 1999 and lowermost Skimikin Lake in 2005, presence of pumpkinseed remains unconfirmed only in Fleming Lake. Based on the lack of historic stocking of pumpkinseed by government agencies in the South Thompson River watershed and the physical and geographic isolation of these waterbodies, it is reasonable to conclude that their pumpkinseed populations were established through one or more unauthorized introductions (Steve Maricle, BC MOE Regional Biologist, pers. comm.).

Physical attributes of Thompson Region lakes containing pumpkinseed are detailed in Table 60. Based on available data, this species may occupy close to 8 km of lake perimeter, over 75 ha of lake surface area and over 19 ha of lake littoral area within the South Thompson River watershed.

Physically isolated from the rest of the South Thompson River watershed, this small lake group does not provide habitat for migratory salmon. However, a variety of native and non-native fish species are present, including eastern brook trout, cutthroat trout, lake chub, peamouth chub, rainbow trout, redside shiner, smallmouth bass, largemouth bass and yellow perch. These species vary in presence and abundance among individual lakes, but all three lakes support, and the middle and upper lakes are connected to downstream waters providing habitat for, native sportfish and other native species (Table 55). Other non-native spiny-rayed fish species have also been reported in all three lakes.

Kootenay Region (Upper Columbia River (Kootenay) Watershed)

Pumpkinseed presence has been confirmed for 13 waterbodies in the Kootenay watershed, including seven lakes and six streams (see Table 61). An unconfirmed occurrence of this species has also been recorded for one additional lake. Based on provincial watershed coding and local knowledge, confirmed and unconfirmed occurrence records for pumpkinseed are distributed across five separate drainage areas, including headwater lakes of the Columbia River, Beaver Creek, the Pend D'Oreille River and tributaries, Kootenay Lake and tributaries in the Creston Valley and Lake Koocanusa and tributaries.

The first recorded occurrence of pumpkinseed in the Kootenay watershed was in Duck Lake in 1955 (UBC Museum, cited in Hatfield and Pollard 2006). This lake is a tributary of the international trans-boundary Kootenay River near Creston, BC. The most recent recorded occurrence for pumpkinseed was in the upper Beaver Creek drainage, a tributary of the international trans-boundary Columbia River near Castlegar, BC, in 2001 (Timberland Consultants Ltd. No date., cited in Hatfield and Pollard 2006).

Provincial records contain no accounts of authorized pumpkinseed stocking in the Kootenay watershed. Though Fraser and Moyie Lakes were stocked with "Bass/Sunfish (General)" during the period of 1901 through 1923 (see Table 29), neither waterbody currently contains pumpkinseed. Also, confirmed and unconfirmed occurrence records for this species are too few and spread over too broad a geographic area to be explained by these early stocking efforts. Though occurrence records in the vicinity of international trans-boundary waters of the Kootenay River, Pend D'Oreille River and Lake Koocanusa may be attributable to movement of pumpkinseed into Canada from established populations in the US, the Columbia River headwaters and Beaver Creek occurrences most likely resulted from independent, unauthorized introductions. Recognized as present, the current status of pumpkinseed in the Kootenay Region is unknown due to their limited distribution and occurrence within already diverse fish communities (Jeff Burrows, MOE Regional Biologist, pers. comm.).

Physical attributes of Kootenay watershed lakes containing pumpkinseed are detailed in Table 62. Based on available data, pumpkinseed may occupy over 426 km of lake perimeter, over 45,900 ha of lake surface area and close to 1,539 ha of lake littoral area in the Kootenay Region.

Physical attributes of Kootenay Region streams containing pumpkinseed are detailed in Table 63. In the absence of detailed stream mapping, it was not possible to estimate the length of stream currently occupied by pumpkinseed in this area of the province.

Kootenay watershed lakes and streams containing confirmed or unconfirmed populations of pumpkinseed support a diverse array of native and other non-native species including burbot, black catfish, brown catfish, bridgelip sucker, bull trout, prickly sculpin, mottled sculpin slimy sculpin shorthead sculpin, chiselmouth, carp, torrent sculpin, largescale sucker, westslope cutthroat trout, Dolly Varden, eastern brook trout, brown trout, kokanee, longnose dace, lake chub, largemouth bass, leopard dace, longnose sucker, lake trout, lake whitefish, northern mountain sucker, mountain whitefish, northern pikeminnow, peamouth chub, pygmy whitefish, rainbow trout, redside shiner, smallmouth bass, Umatilla dace, walleye, white sturgeon and yellow perch. As in other regions, the presence and abundance of these species varies widely among individual lakes and streams. Nine of 14 Kootenay Region waterbodies containing confirmed or unconfirmed occurrences of pumpkinseed provide local habitat for native sportfish and other native species while all but one are connected to such communities in downstream waters (Table 55). Other spiny-rayed fish species have been recorded for seven of 14 waterbodes containing pumpkinseed. Migratory salmon are presently absent from the Kootenay watershed due to obstructions posed by a succession of downstream hydroelectric dams.

Okanagan Region (Lower Columbia River (Okanagan) Watershed)

Eight waterbodies in the Okanagan watershed contain confirmed populations of pumpkinseed, including six lakes and two streams (see Table 64). Unconfirmed pumpkinseed occurrences were recorded for two additional lakes and three streams. Confirmed and unconfirmed pumpkinseed occurrences in headwater lakes and streams of the Kettle River watershed exhibit the isolated individual lake or small lake group and associated inlet and outlet stream distribution that is characteristic of many other spiny-rayed fish occurrences in BC. However, as in the Lower Mainland and Vancouver Island Regions, pumpkinseed are more widespread in low gradient lake and river sections and contiguous tributary waters of the Okanagan River.

The first recorded occurrence of pumpkinseed in the Okanagan watershed identified by Hatfield and Pollard (2006) was in 1947 in Osoyoos Lake (University of BC Museum record, cited in Hatfield and Pollard 2006). However, Dymond (1936) records this species as being present in Christina Lake as early as 1928. The most recent recorded occurrence for this species was in Kalamalka Lake in 1995 (University of BC Museum record, cited in Hatfield and Pollard 2006).

No pumpkinseed populations in the Okanagan Region originated through authorized stocking activities within Canada (Brian Jantz, BC MOE Regional Biologist, pers. comm.). It is possible, however, that pumpkinseed in Osoyoos Lake - an international trans-boundary waterbody - dispersed into Canada from the US. Such movements may have also resulted in pumpkinseed presence in historically unobstructed contiguous waters downstream of Skaha Lake. Dymond (1936) speculates that pumpkinseed may have been inadvertently introduced into Christina Lake along with smallmouth bass by the federal Department of Fisheries in 1901. These fish may have subsequently dispersed downstream to other tributaries of the Kettle River system. Similarly, unauthorized headwater lake introductions (e.g. Swan Lake) followed by downstream dispersal may have resulted in pumpkinseed becoming established in upper mainstem lakes of the Okanagan River system (e.g. Okanagan and Skaha lakes). Excepting these possible instances of trans-boundary and localized dispersal, pumpkinseed populations in the Okanagan Region are thought to have originated through independent, inadvertent or unauthorized introductions (Brian Jantz, BC MOE Regional Biologist, pers. comm.).

Physical attributes of Okanagan Region lakes containing pumpkinseed are detailed in Table 65. Based on available data, pumpkinseed may occupy over 456 km of lake perimeter, over 44,512 ha of lake surface area and nearly 620 ha of lake littoral area within the Okanagan watershed. Physical attributes of Okanagan Region streams containing pumpkinseed are detailed in Table 66. In the absence of detailed stream mapping, it was not possible to estimate the length of stream currently occupied by pumpkinseed in this area of the province.

Okanagan watershed lakes and streams containing confirmed or unconfirmed populations of pumpkinseed support a wide range of native and other non-native species including burbot, black crappie, black catfish, brown catfish, bridgelip

sucker, prickly sculpin, mottled sculpin, slimy sculpin, chinook salmon, chiselmouth, carp, largescale sucker, cutthroat trout, eastern brook trout, goldfish, kokanee, leopard dace, largemouth bass, longnose dace, longnose sucker, lake trout, lake whitefish, mountain whitefish, northern pikeminnow, peamouth chub, pygmy whitefish, rainbow trout, redside shiner, sockeye salmon, smallmouth bass, steelhead, tench and yellow perch. As in other regions, the presence and abundance of these species varies widely among individual lakes and streams. Of waterbodies containing confirmed or unconfirmed populations of pumpkinseed, only Osoyoos Lake and the Okanagan River presently provide habitat for migratory salmon. However, an ongoing experimental outplant of sockeye salmon fry above low head dams on the Okanagan River into Skaha Lake presently provides this species with access to Skaha and Vaseux Lakes. Ten of 13 confirmed or unconfirmed pumpkinseed waterbodies also directly support native sportfish or other native species (Table 55). Nine Okanagan Region waterbodies containing pumpkinseed are connected by surface waters to downstream areas supporting migratory salmon while 12 are connected to downstream areas supporting resident sportfish or other native species. Eight of 13 lake and stream systems containing confirmed or unconfirmed populations of pumpkinseed also contain other non-native spiny-rayed fish species.

WALLEYE

Current Distribution in BC

Walleye presence was confirmed for 35 waterbodies in BC, including 6 lakes or ponds and 29 streams. Of these records, 30 were located within the native range of the species in the Peace River watershed (Figure 12). Though walleye in Swan Lake, Fish Creek and Charlie Lake in the Peace Region were established through stocking by government agencies, they fall within the native range of the species and are not considered further in this report.

Records of non-native walleye presence exist for two regional fisheries management areas of the BC MOE. Names and tributary relationships for walleye records within their non-native provincial range are detailed in Tables 67 and 69, below. A brief account of local walleye distributions within the Kootenay and Okanagan Regions, including timing and mode of introduction and presence of other fish species with which walleye may interact, are provided below.

Distribution, Timing and Mode of Invasion and Spread

The present distribution of walleye within BC is atypical of other non-native spiny-rayed species as it includes contiguous distributions within the species' native range in the Peace River watershed. Non-native walleye distributions are limited to large mainstem rivers (e.g. Columbia, Pend D'Oreille and Kootenay Rivers) and international trans-boundary systems (e.g. Columbia and Kettle Rivers) that provide favourable habitat for this species and serve as avenues of introduction and dispersal.

Kootenay Region (Upper Columbia River (Kootenay) Watershed)

Walleye presence has been confirmed for three streams in the Kootenay watershed (see Table 67). All occurrence records for walleye in the Kootenay Region are from the international trans-boundary area near Castlegar, BC, where the mainstem Pend D'Oreille and Columbia Rivers provide avenues of introduction and dispersal for established walleye populations in the US (Jeff Burrows, MOE Regional Biologist, pers. comm.).

Walleye were first recorded in the Kootenay watershed in 1991 (RL&L Environmental Services Ltd. 1990, Hilderbrand 1992, BC MOE Resource Analysis Branch. No date., all cited in Hatfield and Pollard 2006), originating through dispersal of established Columbia River populations in the US (Jeff Burrows, MOE Regional Biologist, pers. comm.). Though limited in distribution, Kootenay Region walleye are considered to be self-sustaining and abundant (Jeff Burrows, MOE Regional Biologist, pers. comm.).

Physical attributes of Kootenay Region streams containing walleye are detailed in Table 68. In the absence of detailed stream mapping, it was not possible to estimate the length of stream currently occupied by walleye in this area of the province.

Kootenay watershed streams containing confirmed and unconfirmed populations of walleye support a diverse array of native and other non-native species including burbot, black crappie, brown catfish, bridgelip sucker, bull trout, prickly sculpin, mottled sculpin, slimy sculpin, shorthead sculpin, chiselmouth, carp, torrent sculpin, largescale sucker, cutthroat trout, eastern brook trout, brown trout, Arctic grayling, kokanee, leopard dace, lake chub, largemouth bass, longnose dace, longnose sucker, lake trout, lake whitefish, northern mountain sucker, mountain whitefish, northern pikeminnow, peamouth chub, pumpkinseed, pygmy whitefish, rainbow trout, redside shiner, tench, smallmouth bass, Umatilla dace and yellow perch. All three Kootenay Region waterbodies containing walleye provide local habitat and downstream connectivity to receiving waters containing native sportfish and other native species (Table 72). Confirmed and unconfirmed occurrences of other spiny-rayed fish species have also been recorded for all three waterbodies.

Migratory salmon are presently absent from the Kootenay watershed due to obstructions posed by a succession of downstream hydroelectric dams. Upstream dams also presently contain walleye within the trans-boundary area noted above. However, a lock in the Hugh Keenlyside Dam at Castlegar, BC, provides for vessel passage into Lower Arrow Lake. As indicated for smallmouth bass, above, this facility is utilized up to 10 times per day for industrial vessels and as many as 40 times per year for pleasure craft (Dean den Biesen, BC Hydro Environmental Technical Specialist, pers. comm.), and may ultimately

facilitate movement of walleye into upstream waters of the Columbia River mainstem.

Okanagan Region (Lower Columbia River (Okanagan) Watershed)

Walleye presence was confirmed for Christina Lake and the Kettle River in the Okanagan Region (see Table 69). As in the Kootenay Region, occurrence records for walleye in the Okanagan Region are limited to a highly localized international trans-boundary area, in this case near Grand Forks, BC, where the mainstem Kettle River has provided an avenue of introduction and dispersal for established walleye populations in the United States (Brian Jantz, MOE Regional Biologist, pers. comm.). First observation dates for walleye in the Okanagan Region are not recorded (Hatfield and Pollard 2006).

Physical attributes of Christina Lake are detailed in Table 70. Based on available data, walleye may occupy over 44 km of lake perimeter and over 2,500 ha of lake surface area within the Okanagan watershed.

Physical attributes of the Kettle River are detailed in Table 71. In the absence of detailed stream mapping, as was completed for yellow perch but precluded for other species due to time and resource constraints, it was not possible to estimate the length of stream currently occupied by walleye in this area of the province. However, the upstream distribution of this species is presently limited by a natural obstruction to fish movement at Cascade Falls (Brian Jantz, MOE Regional Biologist, pers. comm.).

In addition to walleye, Christina Lake and the Kettle River support a diverse array of native and other non-native species including burbot, brown catfish, bull trout, prickly sculpin, mottled sculpin, shorthead sculpin, chiselmouth, carp, cutthroat trout, eastern brook trout, brown trout, kokanee, largemouth bass, mountain whitefish, northern pikeminnow, pumpkinseed, rainbow trout, redside shiner, speckled dace, smallmouth bass and Umatilla dace, varying in presence and abundance between the lake and stream environments. Both Christina Lake and the Kettle River provide local habitat and downstream connectivity to receiving waters containing native sportfish and other native species (Table 72). Confirmed and unconfirmed occurrences of other spiny-rayed fish species have also been recorded for both waterbodies. Migratory salmon are presently absent from the Kettle River system due to obstructions posed by a succession of downstream hydroelectric dams.

NORTHERN PIKE

Current Distribution in BC

Northern pike presence was confirmed for 164 waterbodies in BC, including 63 lakes or ponds and 101 streams. Of these records, 162 were located within the native range of the species in northern BC (Brendan Anderson, MOE Regional

Biologist, pers. comm.; Paul Giroux, MOE Regional Biologist, pers. comm.). Native range records for northern pike are not considered further in this report as they do not include any known authorized or unauthorized introductions. The distribution of all northern pike occurrence records across the Province is illustrated in Figure 13.

Records of non-native northern pike presence are limited to the Kootenay fisheries management region of the BC MOE. A brief account of northern pike distributions within this region, including timing and mode of introduction and presence of other fish species with which northern pike may interact, are provided below.

Distribution, Timing and Mode of Invasion and Spread

The present distribution of non-native northern pike in BC is typical of other non-native spiny-rayed fish species as it includes both a small headwater lake and a large trans-boundary system that provides favourable habitat and has likely served as an avenue of species introduction and dispersal.

Kootenay Region (Upper Columbia River (Kootenay) Watershed)

Northern pike presence has been confirmed at one location on the Kootenay River, downstream of the international trans-boundary waterbody Lake Koocanusa. This species has also been confirmed in Haha Lake, a small lake tributary to Lake Koocanusa (see Table 73).

Based on local knowledge of BC MOE staff regarding physical and hydrologic conditions of the Haha Creek watershed, northern pike captured in Haha Lake in 2005 likely originated from an unauthorized introduction (Jeff Burrows, MOE Regional Biologist, pers. comm.). However, northern pike are known to be present in Lake Koocanusa, having been captured by Montana Fish, Wildlife and Parks during the period of 1994 -1995 and in 2005 (Jeff Burrows, MOE Regional Biologist, pers. comm.), and these were the likely source population for the single individual captured in the Kootenay River in 2007 (Jeff Burrows, MOE Regional Biologist, pers. comm.). Provincial records contain no accounts of authorized northern pike stocking in the Kootenay watershed.

Physical attributes of Haha Lake are detailed in Table 74, but do not include lake perimeter, surface area or littoral area. Physical attributes of the Kootenay River are detailed in Table 75. However, in the absence of detailed stream mapping, it was not possible to estimate the length of stream currently occupied by northern pike in this area of the province.

As a whole, the Kootenay River supports a diverse array of native and other non-native species including burbot, bridgelip sucker, bull trout, prickly sculpin, mottled sculpin, slimy sculpin, torrent sculpin, largescale sucker, cutthroat trout, eastern brook trout, kokanee, leopard dace, largemouth bass, longnose dace,

longnose sucker, lake whitefish, mountain whitefish, northern pikeminnow, peamouth chub, pumpkinseed, pygmy whitefish, rainbow trout, redside shiner, smallmouth bass, Umatilla dace, walleye, white sturgeon and yellow perch. Of these species, only eastern brook trout, largemouth bass, rainbow trout and yellow perch have been recorded in Haha Lake. Both Haha Lake and the Kootenay River provide local habitat and downstream connectivity to receiving waters containing native sportfish and other native species (Table 76). Confirmed occurrences of other spiny-rayed fish species have also been recorded for both systems. Migratory salmon are absent from the entire Kootenay Region due to obstructions posed by a succession of downstream hydroelectric dams.

MODES OF INVASION AND RATES OF SPREAD

CCFAM (2004) identified seven key pathways for introduction or spread of aquatic invasive species including shipping, recreational and commercial boating, use of live bait, aquarium and water garden trade, live foodfish, unauthorized introductions and canals and water diversions. Species may also be introduced outside of their native range through authorized or government stocking programs. Once established, aquatic invasive species may disperse to adjacent favourable habitats. Based on the regional account provided above, authorized or government introductions, use of live bait, unauthorized introductions and dispersal are potential pathways of introduction and spread for yellow perch, smallmouth bass, largemouth bass, pumpkinseed, walleye and northern pike in BC.

Authorized fish introductions are often conducted by government agencies or by sports groups in partnership with government agencies to create recreational fishing opportunities or to improve the forage base for existing fisheries. Canadian introductions are currently governed by the National Code on Introductions and Transfers of Aquatic Organisms (CCFAM 2003). McPhail (2007) reported that yellow perch, largemouth bass and pumpkinseed have successfully established in most areas where they were introduced. Smallmouth bass, walleye and northern pike have also been widely introduced in the continental United States as food fish and for sportfishing (Scott and Crossman 1973). The stocking of yellow perch (Stony, Kelly, Bearhole and Charlie Lakes) and walleye (Swan Lake, Fish Creek and Charlie Lake) in the Peace River watershed by provincial fisheries staff are recent examples of this type of introduction. Stocking of "Bass/Sunfish (General)" into Florence, Langford, Spider, St. Mary, Fraser, Moyie and Christina lakes during the period of 1901 through 1923 are historical examples that have contributed to the current distribution of these species in BC.(see Tables 19, 29, 32). The BC MOE Freshwater Fisheries Program Invasive Species Management Action Plan recognizes that translocation of species outside of their native range poses significant risks to angling opportunities and native biodiversity and aims to

reduce or eliminate future introductions while controlling or eradicating existing populations in priority waterbodies (BC MOE 2007a).

Of the species considered in this paper, yellow perch are commonly used as cut and live bait for angling other species (Scott and Crossman 1973). Bait fish species may be introduced outside their range through escape or when bait buckets are emptied. Unauthorized introductions of bait fish have been noted in various jurisdictions despite prohibitions against their release (CCFAM 2004). Use of live fish as bait and transport of live fish is prohibited in BC (BC MOE 2007b). Also, the history and types of fishing in BC do not support or require the use of live bait in freshwater systems. Though it is possible that illegal bait fishing may occur, this pathway is not considered to be a significant contributor to the introduction and spread of yellow perch in BC.

Yellow perch were the only species for which confirmed and unconfirmed occurrence records were extrapolated to downstream waters based on species ecology and local knowledge of BC MOE fisheries staff. Based on the regional accounts provided above, isolated lakes, small lake groups and directly associated inlet and outlet streams account for 44 of 82 confirmed and unconfirmed yellow perch occurrences in BC. This count is highly conservative as 12 additional systems are connected to mainstem lake or river populations only via steep, inaccessible extrapolated distributions. The lack of physical connectivity among yellow perch occurrences is a strong indication that these populations originated through independent introductions rather than through inter-provincial or international trans-boundary dispersal. Allowing that six occurrence records in the Peace River watershed were established by government stocking activities and related dispersal, between 54 and 68 percent of yellow perch occurrences in BC likely originated through unauthorized introductions.

In the absence of downstream range extrapolations, it is difficult to draw definitive conclusions from the distribution of regional occurrence records for smallmouth bass, largemouth bass or pumpkinseed. However, based on the regional accounts provided above, confirmed and unconfirmed occurrence records for these species are commonly located within geographically, physically and/or hydrologically isolated lakes, small lake groups and directly associated inlet and outlet streams (Table 77). The lack of confirmed or unconfirmed occurrence records in a common freshwater parent stream or lake to link these records suggests that at least a portion of these populations originated through independent introductions.

It is unknown whether individuals, organized groups or some combination of the two are responsible for unauthorized introductions of spiny-rayed fish species in BC. Recent introductions of yellow perch in the Thompson Region occurred in widely spaced pothole lakes with seasonal to non-existent outlet flows (Figure 4). While these introductions appear spatially unrelated, it is possible that some care was taken to select relatively isolated waterbodies to limit subsequent spread.

Unauthorized introductions of small- and/or largemouth bass have been observed to follow those of yellow perch in some small BC lakes (Hatfield and Pollard 2006), suggesting the species may have been purposefully established as a prey base for other non-native sportfish. Forty-two of 72 lakes and streams in the Kootenay, Okanagan, Thompson, Lower Mainland and Vancouver Island Regions with established yellow perch populations also support smallmouth bass, largemouth bass or walleye. Nine of 10 confirmed and unconfirmed yellow perch waterbodies in the Peace Region also support northern pike or walleye.

Once established, populations of non-native fish can disperse through connected waters into adjacent habitats. In the Kootenay, Okanagan and Lower Mainland Regions, 13 of 54 confirmed and unconfirmed yellow perch occurrences are contiguous with yellow perch bearing trans-boundary waters (i.e. Kootenay River, Lake Koocanusa, Okanagan River and Judson Lake). In the Peace Region, four yellow perch occurrences are contiguous with the native range of the species in Alberta. An additional 31 yellow perch records would be included if contiguous, albeit some likely impassable, extrapolated distributions were included. Thus, between 21 and 59 percent of yellow perch occurrences in the province may be linked to inter-provincial or international trans-boundary dispersal.

Though downstream extrapolations of confirmed and unconfirmed occurrence records were not completed for smallmouth bass, largemouth bass, pumpkinseed, walleye or northern pike, occurrence records for each of these species in the Lower Mainland, Kootenay and Okanagan regions are contiguous with international trans-boundary waters (e.g. Fishtrap Creek, Judson Lake, Kootenay River, Pend D'Oreille River, Lake Koocanusa, Kettle River, Osoyoos Lake). The likelihood that yellow perch and largemouth bass dispersed into Canada from US sources was noted historically by Dymond (1936) and Northcote (1973). More recent trans-boundary dispersal of northern pike into the Kootenay region and walleye into the Kootenay and Okanagan regions has been noted by present-day provincial fisheries managers (Jeff Burrows, MOE Regional Biologist, pers. comm.; Brian Jantz, MOE Regional Biologist, pers. comm.).

A well-established yellow perch fishery exists on St Mary's Lake, Saltspring Island. It had been presumed that the risk of yellow perch dispersal from this waterbody was non-existent as a salt-water channel separates it from neighbouring Vancouver Island rivers. However, yellow perch were recently observed in the estuarine portion of the outlet stream, Duck Creek, having been swept downstream from St Mary's Lake by high flows (Charles Dorworth, pers. comm. to Tom G. Brown, DFO Pacific Biological Station). These fish appeared to be experiencing some difficulty with the increased salinity of the bay. Nonetheless, it is conceivable that these fish could disperse across the salt water channel into the neighbouring Chemainus or Cowichan River systems if a large freshwater lens were to develop during a winter storm. The ability of yellow perch to actually become established in these rivers would depend on suitable habitat being present in their lower reaches.

Hatfield and Pollard (2006) assessed the rate of spread for yellow perch, smallmouth bass, largemouth bass and pumpkinseed in BC based on first observation dates recorded to 2005 (Table 78). Though this approach is confounded by increased awareness and inventory for non-native fish species, it remains of some illustrative value. Clearly, each of these species is capable of survival, establishment, reproduction and spread well beyond their native range and new occurrences continue to be recorded in BC waterbodies.

Regional fisheries biologists of the BC Ministry of Environment speculate that three to five years are required for introduced yellow perch to be observed in the recreational fishery (Steve Maricle, BC MOE Regional Biologist, pers. comm.; Trevor Andrews, BC MOE Regional Biologist, pers. comm.). A similar timeframe was historically noted following stocking of smallmouth bass in Christina Lake (Dymond 1936). Spiny-rayed fish populations in at least 21 BC waterbodies were chemically eradicated between 1950 and 1972 (Table 79). Though introduction dates are unknown, first observation dates for spiny-rayed fish species are available for ten of these systems. These dates indicate that spiny-rayed species were well-established in previously barren waterbodies between 13 and 43 years post-treatment.

CONCLUSION

The native range of smallmouth bass, largemouth bass, pumpkinseed and yellow perch does not include the province of BC. Nonetheless, these species share a long history of arrival, establishment and spread in the province. As detailed above, common vectors of species arrival and spread have included authorized or government introductions, unauthorized introductions and dispersal.

Attempted introductions of bass species into BC by government agencies occurred as early as 1895 (Prince 1902), with successful introductions of smallmouth bass dating from 1901 (Prince 1902, Dymond 1936). Early introductions of smallmouth bass may also have included additional, unrecorded spiny-rayed fish species such as pumpkinseed (Dymond 1936). Though little information is available regarding unauthorized introductions, records of smallmouth bass, largemouth bass, pumpkinseed and yellow perch in physically isolated, unstocked waterbodies date from as early as 1951 (e.g., Okanagan and Shannon lakes). Dispersal of bass, pumpkinseed and yellow perch into Canada from established populations in the US likely preceded such introductions by as much as 30 years (Dymond 1936).

To date, smallmouth bass, largemouth bass, pumpkinseed and yellow perch account for at least 375 occurrence records over at least 268 BC waterbodies. These species are particularly well-established through southern portions of the province in settings ranging from geographically, physically and/or hydrologically isolated individual lakes or small lake groups and directly associated inlet and outlet streams to large mainstem lakes and rivers, including inter-provincial and international trans-boundary systems.

In contrast to the above-noted species, walleye and northern pike are native to British Columbia, albeit only to northern drainages of the Peace and Omineca regions. These species are also relatively recent arrivals outside their native range, with walleye and northern pike first observed in the Kootenay Region in 1981 and 2005, respectively.

As detailed above, the most common vector of arrival and spread for walleye and northern pike outside their native BC range has been trans-boundary dispersal from established US populations. Excepting a single northern pike occurrence in Haha Lake, these species have yet to spread little beyond the lake and river systems that first afforded them access to the province. Altogether, five non-native occurrence records exist for walleye in the Kootenay and Okanagan regions of BC while two non-native occurrence records exist for northern pike in the Kootenay region.

The diversity of waterbodies and geographic settings to which spiny-rayed fish species have been introduced or spread in BC is reflected in the diversity of communities with which they interact. These include as many as 50 native and non-native fish species, including five species of Pacific salmon. Insofar as these interactions and observed and potential impacts are of concern to provincial and federal fisheries managers, the scope, magnitude and diversity of potentially affected populations, communities and ecosystems demand a strategic approach to management response. Though extirpation of isolated non-native fish populations may still be possible, this is unlikely to be possible for all, particularly in the short term. Biological risk assessments for smallmouth bass, largemouth bass, pumpkinseed, yellow perch, walleye and northern pike conducted under the guidance of the DFO Centre of Expertise for Aquatic Risk Assessment provide one means by which species and action priorities may be set. This paper has been completed in support of this risk assessment process.

REFERENCES

Ableson, D.H.G. 1990. Memo to J. Hammond, re: 1982 Yellow Perch Transplant from Swan Lake to Stoney Lake. BC Ministry of Environment Lake File, Fort St. John. Fish Inventory Summary System Reference 701-376.

Balkwill, J.A. 1950. A Reconnaissance Survey of Young Lake. Ministry of Sustainable Resource Management, Victoria, BC. Fish Inventory Summary System Reference BCLKS-780.

Balkwill, J.A. 1967. A Reconnaissance Survey of Vaseux Lake. Ministry of Sustainable Resource Management, Victoria, BC. Fish Inventory Summary System Reference BCLKS-3530.

Best, R. 2001. Documentation of Fish Presence. BC Ministry of Environment, Aquatic Information Branch, Victoria, BC. Fish Inventory Summary System Reference HQ2020.

British Columbia Ministry of Environment [BC MOE]. 2007a. Freshwater Fisheries Program Plan [online]. Available from http://www.env.gov.bc.ca/esd/documents/ff_program_plan.pdf (English) [cited 21 November 2007].

BC MOE. 2007b. Freshwater Fishing Regulations Synopsis 2007-2008. Available from http://www.env.gov.bc.ca/fw/fish/regulations/ (English) [cited 27 November 2007].

BC MOE. 2007c. Stocking query: Province of BC, BS - Bass/Sunfish (General), 1894 to the year 2007. Available from http://srmapps.gov.bc.ca/apps/fidq/ (English) [cited 4 December 2007].

British Columbia Ministry of Environment, Lands and Parks [BC MOELP]. 1995a. Deadman Lake. File #: 34020-20-(02). Fish Inventory Summary System Reference 8286.

BC MOELP. 1995b. Lake Plans - Okanagan Watershed: Skaha Lake. Fish Inventory Summary System Reference 8000.

BC MOELP. 1995c. Lake Plans - Okanagan Watershed: Vaseux Lake. Fish Inventory Summary System Reference 8000.

Canadian Council of Fisheries and Aquaculture Ministers [CCFAM]. 2004. A Canadian Action Plan to Address the Threat of Aquatic Invasive Species. CCFAM, Aquatic Invasive Species Task Group [online]. Available from http://www.dfo-mpo.gc.ca/science/environmental-environnement/action_plan/action_plan_e.htm (English) [cited 21 November 2007].

CCFAM 2003. National Code on Introductions and Transfers of Aquatic Organisms. September 2003. Available from http://www.dfo-mpo.gc.ca/science/aquaculture/code/Code2003_e.pdf (English) [cited 27 November 2007].

Centre of Expertise for Aquatic Risk Assessment [CEARA] [online]. 2007. Available from http://www.dfo-mpo.gc.ca/science/ceara/index_e.htm (English) [cited 21 November 2007].

Coast River Environmental Services Ltd. No date. Fish salvage report. BC Ministry of Environment, Lands and Parks, Surrey, BC.

Dextrase, A. and Mandrak, N. 2006. Impacts of Alien Invasive Species on Freshwater Fauna at Risk in Canada. Biological Invasions 8(1): 13-24.

Dymond, J.R. 1936. Some fresh-water fishes of British Columbia. Reprinted from Report of the Commissioner of Fisheries of British Columbia for the year 1935. Contributions of the Royal Ontario Museum of Zoology 9: L60-L73.

Field, P. and Dickie, T. 1987. Investigations of black bass in the Okanagan sub-unit. Report prepared for the BC Ministry of Environment. BC Conservation Foundation, Surrey. 90 pp.

Griffith, R.P. 1994. A Reconnaissance Survey of Windermere Lake, 1994. MOELP, Fisheries Branch, Nelson, BC. 45pp. Fish Inventory Summary System Reference KO40069.

Hammond, R.J. 1984. Perch Transplant from Sturgeon Lake Alberta to Four BC Lakes - Memo to Regional Manager, August 1984. BC Ministry of Environment Lake Files, Fort St. John. Fish Inventory Summary System Reference 701-361.

Harvey, K. 2001. Yellow Perch in Blackhawk Lake. Memorandum. BC Fisheries, Victoria, BC. Fish Inventory Summary System Reference HQ1741.

Hatfield, T. and Pollard, S. 2006. Non-native Freshwater Fish Species in British Columbia: Biology, Biotic Effects, and Potential Management Actions. Prepared for Freshwater Fisheries Society of British Columbia, Victoria, BC. Draft, October 2006.

Hilderbrand, L. 1992. Pend D'Oreille River (Waneta Reservoir), Preliminary Impact Assessment Of Powerplant Development. 25pp. Location: Ministry of Environment, Lands and Parks, Fisheries Branch, Nelson, BC. Fish Inventory Summary System Reference K040048.

Huston, J.E., Hamlin, P.D., and May, B. 1984. Lake Koocanusa fisheries investigations final report. Prepared for United States Army Corp of Engineers, Seattle District. Seattle, Washington. Fish Inventory Summary System Reference K040092.

International Union for the Conservation of Nature and Natural Resources [IUCN]. 2000. IUCN Guidelines for the Prevention of Bicdiversity Loss caused by Alien Invasive Species. Information Paper. Fifth Meeting of the Conference of the Parties to the Convention on Biological Diversity (Nairobi, Kenya 15-26 May 2000).

Lyons, J.C. 1951. A Partial Survey of Shannon Lake. Ministry of Sustainable Resource Management, Victoria, BC. Fish Inventory Summary System Reference BCLKS-3590.

McPhail, J.D. 2007. The Freshwater Fishes of British Columbia. The University of Alberta Press, Edmonton, AB. 620 pp.

McPhail, J.D. and Carveth, R. 1994. Field Key to the Freshwater Fishes of British Columbia. Draft for 1994 Field Testing. Aquatic Inventory Task Force of the Resources Inventory Committee. 233 pp.

Maher, F.P. 1956. July and August Monthly Regional Report. Ministry of Sustainable Resource Management, Victoria, BC. Fish Inventory Summary System Reference BCLKS-4036.

Northcote, T.G. 1973. Some impacts of man on Kootenay Lake and its salmonids. Great Lakes Fishery Commission, Technical Report Number 25, 40 pages.

Pearson, M. 1998. Habitat inventory and enhancement needs for the endangered Salish sucker (Catostomus sp.) and Nooksack dace (Rhinichthys sp.). Fisheries Project Report No. 76. BC Fisheries, Victoria.

Prince, E.E. 1902. Thirty-fourth Annual Report, Marine and Fisheries, 1901. Department of Fisheries, Ottawa.

RL&L Environmental Services Ltd. 1990. Lower Columbia River Fisheries Inventory 1990 Studies. 225pp. Location: Ministry of Environment, Lands and Parks, Fisheries Branch, Nelson, BC. Fish Inventory Summary System Reference K040042.

Scott Resource Services Inc. No date. Fish collection report. BC Ministry of Environment, Lands and Parks, Surrey, BC.

Scott, W.B. and Crossman, E.J. 1973. Freshwater Fishes of Canada. (Reprinted 1990). Fisheries Research Board of Canada, Bulletin 184, 966 pages.

Spatial Vision Consulting Ltd. 1996. An Introduction to the Watershed Atlas. April 1996. Revision 2.1 BC Ministry of Environment, Lands and Parks, Fisheries Branch, Victoria, BC. 26 pp.

Thirkill, C. 2000. Fish Sampling in Cat Creek, Beaver Creek and Departure Creek. Ministry of Sustainable Resource Management, Victoria, BC. Fish Inventory Summary System Reference HQ1926.

Timberland Consultants Ltd. No date. Field Data Information System Record. BC Ministry of Environment, Nelson, BC.

Unknown. 1944. Lake Overview Data - Christina Lake. Location : Ministry Of Sustainable Resource Management, Victoria, BC. Fish Inventory Summary System Reference BCLKS-5590.

Vernon, E.H. 1953. Report on the Death of Fish in Swan Lake, Victoria. Ministry of Sustainable Resource Management, Victoria, BC. Fish Inventory Summary System Reference BCLKS-1058

TABLES

Table 1 BC Ministry of Environment fisheries management regions and corresponding geographic regions containing confirmed and/or unconfirmed occurrence records of yellow perch, smallmouth bass, largemouth bass, pumpkinseed, walleye or northern pike.

BC Ministry of Environment Region	Geographic Region
Vancouver Island Region	Vancouver Island and Gulf Islands
Lower Mainland Region	Lower Fraser River Watershed
Thompson Region	South Thompson River Watershed
Cariboo Region	Middle Fraser River Watershed
Kootenay Region	Upper Columbia River (Kootenay) Watershed
Okanagan Region	Lower Columbia River (Okanagan) Watershed
Peace Region	Peace River Watershed

Table 2 Names and record status for waterbodies containing yellow perch on Vancouver Island (VI), Saltspring (SI) Island and in the lower Fraser River (FR) watershed. The lowermost of contiguous waterbodies are displayed in bold text; tributary relationships are indicated by inset text.

Vancouver and Saltspring Islands and the Lower Fraser River Watershed		
Gazetted Name (Local Name)		**Status of Record**
Mill Stream (Hazlitt Creek) (VI)		Extrapolated
Unnamed		Extrapolated
Florence Lake		Confirmed
Colquitz River (Colquitz Creek) (VI)		Extrapolated
Elk Lake (Elk-Beaver Lake)		Confirmed
Beaver Lake (Beaver-Elk Lake)		Confirmed
Tod Creek (VI)		Extrapolated
Prospect Lake		Confirmed
Goldstream River (VI)		Extrapolated
Langford Creek		Extrapolated
Langford Lake		Confirmed
Shawnigan Creek (Mill Bay Creek, Mill Stream Creek) (VI)		Extrapolated
Shawnigan Lake		Confirmed
Glen Urquhart Creek (VI)		Confirmed
Unnamed		Extrapolated
Duck Creek (SI)		Extrapolated
St. Mary Lake		Confirmed
Rogers Creek (Roger Creek) (VI)		Extrapolated
Stokes Creek		Extrapolated
Loon Lake		Unconfirmed
Judson Lake (FR)		Confirmed
Totals	**Confirmed**	9
	Unconfirmed	1
	Extrapolated	11
	All	**21**

Table 3 Names and physical characteristics of lakes containing yellow perch on Vancouver and Saltspring Islands and in the lower Fraser River watershed. "No data" indicates physical characteristics for which no data were available in BC Ministry of Environment compiled datasets. Italicised text indicates data derived through analysis of project mapping.

Vancouver and Saltspring Islands and the Lower Fraser River Watershed						
Gazetted Name (Local Name)		**Perimeter (m)**	**Surface Area (ha)**	**Littoral Area (ha)**	**Maximum Depth (m)**	**Mean Depth (m)**
Florence Lake		1,716	11.9	11.9	5.5	3.3
Elk Lake (Elk-Beaver Lake)		9,760	216.1	125.3	16.8	8.5
Beaver Lake (Beaver-Elk Lake)		3,653	37.5	33.9	7.6	3.4
Prospect Lake		4,670	59.8	22.0	14.0	6.7
Langford Lake		4,510	61.2	33.3	17.0	6.5
Shawnigan Lake		25,200	537.0	134.0	50.0	12.0
Unnamed		*1,460*	2.7	no data	no data	no data
St. Mary Lake		7,950	189.6	133.7	17.0	9.3
Loon Lake		1,143	7.0	3.2	13.7	6.1
Judson Lake		2,600	24.3	no data	no data	no data
Totals (# of lakes)	**Confirmed**	60,059 (8)	1,137.4 (8)	494.1 (7)		
	Unconfirmed	1,143 (1)	7.0 (1)	3.2 (1)		
	Extrapolated	1,461 (1)	2.7 (1)	no data		
	All	**62,345 (10)**	**1,147.1 (10)**	**497.3 (8)**		

Table 4 Names and physical characteristics of streams containing yellow perch (YP) on Vancouver and Saltspring Islands and in the lower Fraser River watershed. "No data" indicates physical characteristics for which no data were available in BC Ministry of Environment and/or Environment Canada compiled datasets. Italicised text indicates data derived through analysis of project mapping.

Vancouver and Saltspring Islands and the Lower Fraser River Watershed				
Gazetted Name (Local Name)	**Stream Order**	**Stream Magnitude**	**YP Stream Length (km)**	**Stream Mean Discharge (m^3s^{-1})**
Mill Stream (Hazlitt Creek)	3	7	*3.0*	no data
Unnamed	2	2	2.0	no data
Colquitz River (Colquitz Creek)	3	17	9.6	no data
Tod Creek	3	8	*5.6*	0.035[2]
Goldstream River	3	18	*2.6*	no data
Langford Creek	2	3	1.7	no data
Shawnigan Creek (Mill Bay Creek)	3	17	*10.1*	1.470[3]
Glen Urquhart Creek	3	5	3.4	1.750
Duck Creek	1	1	3.0	0.011[4]
Rogers Creek (Roger Creek)	2	4	*9.9*	no data
Stokes Creek	1	1	*5.0*	no data
Totals (# of streams)	**Confirmed**		3.4 (1)	
	Unconfirmed		-	
	Extrapolated		52.5 (10)	
	All		**19.7 (5)**	

[2] Hydrometric data for inactive WSC station 08HA054 (February 28, 2007).
[3] Hydrometric data for inactive WSC station 08HA004 (March 1, 2007).
[4] Hydrometric data for inactive WSC station 08HA027 (February 28, 2007).

Table 5 Number of waterbodies having confirmed or unconfirmed occurrences of yellow perch that provide local habitat or downstream connectivity to waterbodies containing salmon and native sportfish or other native species in fisheries management regions of the BC Ministry of Environment.

Region	Local Habitat		Downstream Connectivity		Number of Yellow Perch Occurrences in Region
	Salmon	Native Sportfish or Other Native Species	Salmon	Native Sportfish or Other Native Species	
Vancouver Island and Lower Mainland	2	9	9	9	10
Thompson	2	11	7	9	12
Kootenay	*	26	*	20	31
Okanagan	1**	16	8	10	19
Peace	*	10	*	10	10
Total	**5**	**71**	**28**	**60**	**82**

* Migratory salmon are absent from the Peace and Kootenay Regions.

** Though an ongoing experiment provides sockeye salmon access to Skaha Lake, mainstem river dams normally limit access by migratory salmon to portions of the Okanagan Region downstream of this waterbody.

Table 6 Names and record status for waterbodies containing yellow perch in the South Thompson River watershed. The lowermost of contiguous waterbodies are displayed in bold text; tributary relationships are indicated by inset text.

South Thompson River Watershed		
Gazetted Name (Local Name)		**Status of Record**
Hiuihill Creek (Bear Creek)		Confirmed
Skmana Lake Creek		Extrapolated
Skmana Lake (Lake #719)		Confirmed
Unnamed (Little Skmana Lake)		Confirmed
Sinmax Creek (Pass Creek)		Confirmed
Forest Lake (Lake #667)		Confirmed
Unnamed (Nellies Lake)		Confirmed
Gardom Creek		Extrapolated
Gardom Lake		Confirmed
Cedar Creek (White Creek)		Confirmed
Skimikin Lake (Lake #4368)		Confirmed
Skimikin Creek		Extrapolated
Unnamed		Extrapolated
Fleming Lake (Lake #4367)		Confirmed
Phillips Lake (Lake #4268)		Confirmed
Miller Lake (Lake #4361)		Confirmed
Totals	**Confirmed**	12
	Unconfirmed	-
	Extrapolated	4
	All	**16**

Table 7 Names and physical characteristics of lakes containing yellow perch in the South Thompson River watershed. "No data" indicates physical characteristics for which no data were available in BC Ministry of Environment compiled datasets. Italicised text indicates data derived through analysis of project mapping.

South Thompson River Watershed						
Gazetted Name (Local Name)		**Perimeter (m)**	**Surface Area (ha)**	**Littoral Area (ha)**	**Maximum Depth (m)**	**Mean Depth (m)**
Phillips Lake (Lake #4268)		4,000	56.0	no data	10.0	6.0
Skmana Lake (Lake #719)		4,500	43.7	no data	14.2	8.0
Unnamed (Little Skmana Lake)		*1,063*	*3.2*	no data	no data	no data
Forest Lake (Lake #667)		3,219	25.4	10.9	10.1	4.9
Unnamed (Nellies Lake)		*1,413*	*5.3*	no data	no data	no data
Gardom Lake		4,090	75.9	31.2	23.8	8.8
Skimikin Lake (Lake #4368)		2,867	19.5	19.5	4.5	no data
Fleming Lake (Lake #4367)		1,106	*1.7*	no data	5.0	no data
Miller Lake (Lake #4361)		*1,716*	16.1	no data	12.0	no data
Totals (# of lakes)	**Confirmed**	23,974 (9)	246.8 (9)	61.6 (3)		
	Unconfirmed	-	-	-		
	Extrapolated	-	-	-		
	All	**23,974 (9)**	**246.8 (9)**	**61.6 (3)**		

Table 8 Names and physical characteristics of streams containing yellow perch (YP) in the South Thompson River watershed. "No data" indicates physical characteristics for which no data were available in BC Ministry of Environment and/or Environment Canada compiled datasets. Italicised text indicates data derived through analysis of project mapping.

South Thompson River Watershed				
Gazetted Name (Local Name)	**Stream Order**	**Stream Magnitude**	**YP Stream Length (km)**	**Stream Mean Discharge (m^3s^{-1})**
Hiuihill Creek (Bear Creek)	3	12	*8.8*	1.750[5]
Skmana Lake Creek	1	1	0.5	no data
Sinmax Creek (Pass Creek)	4	38	*17.4*	0.469[6]
Gardom Creek	2	2	6.5	0.033[7]
Cedar Creek (White Creek)	3	10	*0.3*	0.396[8]
Skimikin Creek	2	3	*1.3*	no data
Unnamed	1	1	0.9	no data
Totals (# of streams)	**Confirmed**		26.5 (3)	
	Unconfirmed		-	
	Extrapolated		9.2 (4)	
	All		**35.7 (7)**	

[5] Hydrometric data for WSC station 08LD006 (January 26, 2007).
[6] Hydrometric data for inactive WSC station 08LD004 (February 25, 2007)
[7] Hydrometric data for inactive WSC station 08LC036 (February 25, 2007).
[8] Hydrometric data for WSC 08LE039 (February 19, 2007).

Table 9 Names and record status for waterbodies containing yellow perch in the upper Columbia River (Kootenay) watershed. The lowermost of contiguous waterbodies are displayed in bold text. Tributary relationships are indicated by inset text. Bold italicised text indicates an independent tributary relationship to the last preceding bold text parent stream.

Upper Columbia River (Kootenay) Watershed	
Gazetted Name (Local Name)	**Status of Record**
Columbia River (Bush Arm)	Confirmed
Lower Arrow Lake	Confirmed
Upper Arrow Lake (Beatton Arm, Galena Bay)	Extrapolated
Locks Creek	Extrapolated
Williamson Lake	Confirmed
Pend D'Oreille River	Confirmed
Erie Creek	Extrapolated
Divide Creek (Erie Lake Inlet)	Extrapolated
Erie Lake (Beaver Lake)	Confirmed
Lomond Lake (Lomonde Lake)	Confirmed
Kootenay River (Lower) (Hoder Creek Tributary)	Confirmed
Kootenay Lake (West Arm)	Confirmed
Duck Creek	Confirmed
Duck Lake	Confirmed
Six Mile Slough	Confirmed
Unnamed	Extrapolated
Leach Lake	Confirmed
Unnamed (Nick Slough)	Extrapolated
Unnamed (Nick Slough)	Confirmed
Corn Creek (Sloughs)	Confirmed
French Slough	Confirmed
Hanson Creek (Wasa Lake Creek)	Confirmed
Wasa Lake (Hanson Lake)	Confirmed
Unnamed	Extrapolated
Unnamed	Extrapolated
Louis Slough	Extrapolated
Lewis Creek	Confirmed
Mineral Lake	Confirmed
Monroe Creek	Extrapolated
Monroe Lake	Confirmed
Lake Koocanusa (Libby Reservoir)	Confirmed
Haha Creek	Extrapolated
Lund Lake	Confirmed
Haha Lake (Rothwell Lake)	Confirmed
Unnamed (Alta Lake)	Confirmed
Bednorski Lake (Johnson Lake)	Confirmed
Unnamed (Lost Lake)	Confirmed
Baynes Lake	Confirmed
Tie Lake Creek	Extrapolated
Unnamed	Extrapolated
Tie Lake	Confirmed
(Spring Lake)	Confirmed
Jim Smith Creek	Extrapolated

Elizabeth Lake		Extrapolated
Jim Smith Lake		Confirmed
Hiawatha Lake (Sandberg's Lake)		Confirmed
Totals	**Confirmed**	31
	Unconfirmed	-
	Extrapolated	15
	All	**46**

Table 10 Names and physical characteristics of lakes containing yellow perch in the upper Columbia River (Kootenay) watershed. "No data" indicates physical characteristics for which no data were available in BC Ministry of Environment compiled datasets. Italicised text indicates data derived through analysis of project mapping.

Upper Columbia River (Kootenay) Watershed					
Gazetted Name (Local Name)	**Perimeter (m)**	**Surface Area (ha)**	**Littoral Area (ha)**	**Maximum Depth (m)**	**Mean Depth (m)**
Lower Arrow Lake	*223,565*	16,389.6	no data	179.8	no data
Upper Arrow Lake	*345,084*	22,948.1	no data	288.9	no data
Williamson Lake	1,189	4.5	4.5	5.5	2.1
Erie Lake (Beaver Lake)	3,177	32.4	no data	14.3	5.1
Lomond Lake (Lomonde Lake)	1,120	6.9	6.9	6.4	4.5
Kootenay Lake (West Arm)	346,850	41,730.6	no data	155.0	102.2
Duck Lake	*19,717*	*1,693.9*	no data	no data	no data
Six Mile Slough	*20,926*	*741.5*	no data	no data	no data
Leach Lake	*12,315*	*446.3*	no data	no data	no data
Wasa Lake (Hanson Lake)	6,977	101.9	no data	13.1	3.8
Unnamed	*639*	*2.4*	no data	no data	no data
Louis Slough	*2,105*	*17.0*	no data	no data	no data
Mineral Lake	1,320	7.4	1.4	25.0	14.4
Monroe Lake	5,148	47.4	no data	30.8	12.8
Lake Koocanusa (Libby Reservoir)	*188,940*	*6,733.4*	no data	no data	no data
Lund Lake	1,500	9.8	5.6	18.0	6.5
Haha Lake (Rothwell Lake)	*1,461*	13.8	no data	8.5	6.1
Unnamed (Alta Lake)	*872*	*3.9*	no data	no data	no data
Bednorski Lake (Johnson Lake)	1,333	9.6	no data	13.1	8.5
Unnamed (Lost Lake)	*823*	*4.3*	no data	no data	no data
Baynes Lake	2,652	28.1	no data	15.2	7.3
Unnamed	*1,862*	*16.3*	no data	no data	no data
Tie Lake	*10,941*	126.3	126.3	4.9	2.2
Spring Lake	*1,109*	*5.5*	no data	no data	no data
Elizabeth Lake	*1,928*	*8.3*	no data	no data	no data
Jim Smith Lake	2,359	21.5	no data	7.3	4.9
Hiawatha Lake (Sandberg's Lake)	845	4.1	4.1	5.2	2.6
Totals (# of lakes) **Confirmed**	855,139 (22)	68,162.7 (22)	144.7 (6)		
Unconfirmed	-	-	-		
Extrapolated	351,618 (5)	22,992.1 (5)	no data		
All	**1,206,757 (27)**	**91,154.8 (27)**	**144.7 (6)**		

Table 11 Names and physical characteristics of streams containing yellow perch (YP) in the upper Columbia River (Kootenay) watershed. "No data" indicates physical characteristics for which no data were available in BC Ministry of Environment and/or Environment Canada compiled datasets. Italicised text indicates data derived through analysis of project mapping.

Upper Columbia River (Kootenay) Watershed				
Gazetted Name (Local Name)	**Stream Order**	**Stream Magnitude**	**YP Stream Length (km)**	**Stream Mean Discharge (m^3s^{-1})**
Columbia River (Bush Arm)	8	15,639	*58.0*	2,840[9]
Locks Creek	1	1	0.6	no data
Pend D'Oreille River	6	420	2.8	no data
Erie Creek	5	70	*6.4*	no data
Divide Creek (Erie Lake Inlet)	3	7	*0.4*	no data
Kootenay River (Lower) (Hoder Creek Tributary)	7	5,257	*118.7*	792[10]
Duck Creek	4	34	*6.4*	no data
Unnamed	1	1	*1.1*	no data
Unnamed (Nick Slough)	4	48	*1.2*	no data
Unnamed (Nick Slough)	1	1	2.4	no data
Corn Creek (Sloughs)	4	38	*3.8*	3.890[11]
French Slough	2	7	*5.7*	no data
Hanson Creek (Wasa Lake Creek)	2	8	0.8	no data
Unnamed	2	7	*0.7*	no data
Lewis Creek	2	6	no data	0.229[12]
Monroe Creek	2	4	2.1	no data
Haha Creek	4	14	*8.8*	no data
Tie Lake Creek	1	1	4.0	no data
Jim Smith Creek	3	6	*8.9*	no data
Totals (# of streams)	**Confirmed**		198.6 (8)	
	Unconfirmed		-	
	Extrapolated		34.2 (10)	
	All		**232.8 (18)**	

[9] Hydrometric data for WSC station 08NE058 (February 14, 2007).
[10] Hydrometric data for WSC station 08NJ158 (February 14, 2007).
[11] Hydrometric data for WSC station 08NH068 (February 15, 2007).
[12] Hydrometric data for WSC station 08NG084 (February 15, 2007).

Table 12 Names and record status for waterbodies containing yellow perch in the lower Columbia River (Okanagan) watershed. The lowermost of contiguous waterbodies are displayed in bold text. Tributary relationships are indicated by inset text. Italicised text indicates an independent tributary relationship to the last preceding parent stream. Bold italicised text indicates an independent tributary relationship to the last preceding bold text parent stream.

Lower Columbia River (Okanagan) Watershed	
Gazetted Name (Local Name)	**Status of Record**
Okanagan River (Okanagan River Channel)	Extrapolated
Osoyoos Lake	Confirmed
Gallagher Lake	Confirmed
Vaseux Lake	Confirmed
Skaha Lake	Confirmed
Okanagan Lake	Confirmed
Powers Creek	Extrapolated
North Powers Creek	Confirmed
Lambly Lake (Bear Lake)	Confirmed
Vernon Creek (Dee Creek)	Extrapolated
Kalamalka Lake (Long Lake)	Confirmed
B.X. Creek	Extrapolated
Swan Lake (Vernon Lake)	Confirmed
Equesis Creek	Confirmed
Pinaus Lake	Confirmed
Little Pinaus Lake	Confirmed
Unnamed	Extrapolated
Deadman Lake	Confirmed
Unnamed (Ford Lake)	Extrapolated
Unnamed	Unconfirmed
Yellow Lake	Confirmed
Marama Creek	Extrapolated
Trout Lake (Lusk Lake)	Confirmed
Shannon Lake	Confirmed
Unnamed (Royal York Golf Course)	Confirmed
Arlington Lakes (Arlington Lake #3)	Unconfirmed
Totals **Confirmed**	17
Unconfirmed	2
Extrapolated	7
All	**26**

Table 13 Names and physical characteristics of lakes containing yellow perch in the lower Columbia River (Okanagan) watershed. "No data" indicates physical characteristics for which no data were available in BC Ministry of Environment compiled datasets. Italicised text indicates data derived through analysis of project mapping.

Lower Columbia River (Okanagan) Watershed					
Gazetted Name (Local Name)	**Perimeter (m)**	**Surface Area (ha)**	**Littoral Area (ha)**	**Maximum Depth (m)**	**Mean Depth (m)**
Osoyoos Lake	47,900	2,300.0	no data	63.0	14.0
Gallagher Lake	1,017	6.3	no data	17.7	10.4
Vaseux Lake	10,802	274.4	no data	26.8	6.4
Skaha Lake	30,700	1,960.0	392.0	56.7	26.6
Okanagan Lake	268,564	34,441.0	no data	242.0	75.0
Lambly Lake (Bear Lake)	*6,729*	*81.8*	no data	no data	no data
Kalamalka Lake (Long Lake)	42,400	2,590.0	no data	142.0	59.0
Swan Lake (Vernon Lake)	11,280	438.3	227.9	9.0	5.6
Pinaus Lake	8,851	168.8	no data	53.6	13.1
Little Pinaus Lake	*1,701*	*8.4*	no data	no data	no data
Deadman Lake	*1,555*	*10.8*	no data	no data	no data
Unnamed (Ford Lake)	*856*	*3.1*	no data	no data	no data
Yellow Lake	4,549	32.5	no data	39.3	20.1
Trout Lake (Lusk Lake)	*1,022*	*5.3*	no data	no data	no data
Shannon Lake	1,770	18.2	no data	18.9	8.2
Unnamed (Royal York Golf Course)	*no data*	*no data*	no data	no data	no data
Arlington Lakes (Arlington Lake #3)	2,286	18.5	11.7	25.6	9.0

Totals (# of lakes)	**Confirmed**	438,840 (14)	42,335.8 (14)	620.0 (3)
	Unconfirmed	2,286 (1)	18.5 (1)	11.7 (1)
	Extrapolated	856 (1)	3.1 (1)	no data
	All	**441,982 (16)**	**42,357.4 (16)**	**631.7 (4)**

Table 14 Names and physical characteristics of streams containing yellow perch (YP) in the lower Columbia River (Okanagan) watershed. "No data" indicates physical characteristics for which no data were available in BC Ministry of Environment and/or Environment Canada compiled datasets. Italicised text indicates data derived through analysis of project mapping.

Lower Columbia River (Okanagan) Watershed				
Gazetted Name (Local Name)	**Stream Order**	**Stream Magnitude**	**YP Stream Length (km)**	**Stream Mean Discharge (m^3s^{-1})**
Okanagan River (Okanagan River Channel)	6	1,556	37.4	19.100[13]
Powers Creek	4	27	*16.0*	0.767[14]
North Powers Creek	3	7	*4.8*	no data
Vernon Creek (Dee Creek)	5	159	*4.6*	0.941[15]
B.X. Creek	3	26	*5.0*	0.289[16]
Equesis Creek	4	43	*28.0*	0.627[17]
Unnamed	1	1	*1.3*	no data
Unnamed	1	1	0.9	no data
Marama Creek	3	10	2.8	no data
Totals (# of streams)	**Confirmed**		32.8 (2)	
	Unconfirmed		0.9 (1)	
	Extrapolated		67.1 (6)	
	All		**100.8 (9)**	

[13] Hydrometric data for inactive WSC station 08NM085 (February 27, 2007)
[14] Hydrometric data for inactive WSC station 08NM157 (February 27, 2007)
[15] Hydrometric data for inactive WSC station 08NM065 (February 27, 2007)
[16] Hydrometric data for inactive WSC station 08NM123 (November 30, 2007)
[17] Hydrometric data for inactive WSC station WSC 08NM161 (February 17, 2007).

Table 15 Names and record status for waterbodies containing yellow perch in the Peace River watershed. The lowermost of contiguous waterbodies are displayed in bold text. Tributary relationships are indicated by inset text. Bold italicised text indicates an independent tributary relationship to the last preceding bold text parent stream.

Peace River Watershed		
Gazetted Name (Local Name)		**Status of Record**
Peace River (Riviere de la Paix)		Confirmed
Pouce Coupe River		Confirmed
Tupper River		Confirmed
Swan Lake		Confirmed
Stony Lake		Confirmed
Kelly Lake		Unconfirmed
Kiskatinaw River		Extrapolated
Bearhole Lake		Confirmed
Unnamed (Unnamed tributary to Blackhawk Lake)		Extrapolated
Blackhawk Lake (99 Lake)		Confirmed
Fish Creek (Stoddart Creek)		Confirmed
Charlie Lake		Confirmed
Totals	**Confirmed**	9
	Unconfirmed	1
	Extrapolated	2
	All	**12**

Table 16 Names and physical characteristics of lakes containing yellow perch in the Peace River watershed. "No data" indicates physical characteristics for which no data were available in BC Ministry of Environment compiled datasets. Italicised text indicates data derived through analysis of project mapping.

Peace River Watershed						
Gazetted Name (Local Name)		**Perimeter (m)**	**Surface Area (ha)**	**Littoral Area (ha)**	**Maximum Depth (m)**	**Mean Depth (m)**
Swan Lake		15,800	600.0	510.0	7.6	3.1
Stony Lake		6,240	84.6	66.5	7.0	4.0
Kelly Lake		5,950	201.9	201.9	6.0	3.5
Bearhole Lake		7,650	157.7	100.7	11.0	4.5
Blackhawk Lake (99 Lake)		9,590	203.6	203.6	1.8	0.8
Charlie Lake		38,000	1,787.0	691.0	15.0	6.4
Totals (# of lakes)	**Confirmed**	77,280 (5)	2,832.9 (5)	1571.8 (5)		
	Unconfirmed	5,950 (1)	201.9 (1)	201.9 (1)		
	Extrapolated	-	-	-		
	All	**83,230 (6)**	**3,034.8 (6)**	**1,773.7 (6)**		

Table 17 Names and physical characteristics of streams containing yellow perch (YP) in the Peace River watershed. "No data" indicates physical characteristics for which no data were available in BC Ministry of Environment and/or Environment Canada compiled datasets. Italicised text indicates data derived through analysis of project mapping.

Peace River Watershed					
Gazetted Name (Local Name)	**Stream Order**	**Stream Magnitude**	**YP Stream Length (km)**	**Stream Mean Discharge (m^3s^{-1})**	
Peace River (Riviere de la Paix)	8	35,856	*357.9*	1,580[18]	
Pouce Coupe River	5	214	*49.8*	7.430[19]	
Tupper River	4	86	*29.6*	no data	
Kiskatinaw River	5	957	*25.8*	9.950[20]	
Unnamed (Unnamed tributary to Blackhawk Lake)	2	8	*5.9*	no data	
Fish Creek (Stoddart Creek)	4	78	*14.6*	0.487[21]	
Totals (# of streams)	**Confirmed**		451.9 (4)		
	Unconfirmed		-		
	Extrapolated		31.7 (2)		
	All		**483.6 (6)**		

[18] Hydrometric data for inactive WSC station 08HA054 (January 19, 2007).
[19] Hydrometric data for inactive WSC station 08NN003 (January 19, 2007).
[20] Hydrometric data for inactive WSC station 07FD001 (March 1, 2007).
[21] Hydrometric data for inactive WSC station WSC 07FC004 (January 22, 2007).

Table 18 Names and record status for waterbodies containing smallmouth bass on Vancouver and the Gulf Islands. The lowermost shared parent stream is displayed in bold text. Tributary relationships are indicated by inset text. Bold italicised text indicates an independent tributary relationship to the last preceding bold text parent stream.

Vancouver and the Gulf Islands	
Gazetted Name (Local Name)	**Status of Record**
Colwood Creek (Glen Lake Creek)	Confirmed
Glen Lake	Confirmed
Mill Stream (Hazlitt Creek)	Confirmed
Second Lake	Confirmed
Mitchell Lake (First Lake)	Confirmed
Matson Lake	Confirmed
Florence Lake	Confirmed
Third Lake	Confirmed
Craigflower Creek	Confirmed
Prior Lake Creek	Confirmed
Thetis Lake (Lower, Upper Thetis Lake)	Confirmed
McKenzie Lake (McKenzie Ponds)	Confirmed
Colquitz River (Colquitz Creek)	Confirmed
Elk Lake (Elk-Beaver Lake)	Confirmed
Beaver Lake (Beaver-Elk Lake)	Confirmed
Tod Creek	Confirmed
Prospect Lake	Confirmed
Maltby Lake	Confirmed
Durrance Creek	Confirmed
Durrance Lake	Confirmed
Killarney Lake	Confirmed
Lubbe Lake	Confirmed
Langford Lake	Confirmed
Spectacle Lake	Confirmed
Johns Creek	Confirmed
Oliphant Lake	Confirmed
Shawnigan Lake	Confirmed
Cowichan Lake	Unconfirmed
Beaver Creek	Confirmed
Beaver Lake	Confirmed
Fuller Lake	Confirmed
Chemainus Lake (Weddle Lake, Askew Lake)	Confirmed
Unnamed	Confirmed
Unnamed	Confirmed
Nanaimo Lakes (First Nanaimo Lake)	Unconfirmed
***Fourth Lake* (Fourth Nanaimo)**	Unconfirmed
Brannen Lake	Confirmed
Westwood Lake	Confirmed
Diver Lake	Confirmed
Long Lake	Confirmed

Bloods Creek		Confirmed
Green Lake		Confirmed
Kinkade Creek		Confirmed
Illusion Lakes		Confirmed
Spider Lake		Confirmed
St. Mary Lake		Confirmed
Bullocks Lake		Confirmed
Cusheon Lake		Confirmed
Quarantine Lake		Confirmed
Matheson Lake		Confirmed
De Mamiel Creek		Confirmed
Young Lake		Confirmed
Kemp Lake		Confirmed
Totals	**Confirmed**	50
	Unconfirmed	3
	All	53

Table 19 Provincial Bass/Sunfish (General) stocking records for Vancouver and Saltspring Islands (BC MOE 2007c).

Gazetted Name (Local Name)	Fish Count	Source/Strain	Life Stage	Year
Florence Lake	500	Bay of Quinte, ON/ Bay of Quinte, ON	Fry	1901
Langford Lake	500	Bay of Quinte, ON/ Bay of Quinte, ON	Fry	1901
Spider Lake	2	Florence Lake/ Bay of Quinte, ON	Unknown	1923
Spider Lake	8	Florence Lake/ Bay of Quinte, ON	Unknown	1923
Spider Lake	18	Florence Lake/ Bay of Quinte, ON	Fingerling	1923
Spider Lake	120	Florence Lake/ Bay of Quinte, ON	Unknown	1923
St. Mary Lake	18	Langford Lake/ Bay of Quinte, ON	Unknown	1920
St. Mary Lake	25	Langford Lake/ Bay of Quinte, ON	Unknown	1920

Table 20 Names and physical characteristics of lakes containing smallmouth bass on Vancouver and the Gulf Islands. "No data" indicates physical characteristics for which no data were available in BC Ministry of Environment compiled datasets.

Vancouver and the Gulf Islands					
Gazetted Name (Local Name)	**Perimeter (m)**	**Surface Area (ha)**	**Littoral Area (ha)**	**Maximum Depth (m)**	**Mean Depth (m)**
Glen Lake	2,113	6.5	5.4	9.4	2.8
Second Lake	1,109	3.0	0.2	7.9	1.8
Mitchell Lake (First Lake)	1,158	3.4	no data	3.0	1.7
Matson Lake	1,006	11.9	11.9	5.5	3.3
Florence Lake	1,716	3.5	3.5	4.9	2.4
Third Lake	829	35.5	30.6	9.0	2.8
Thetis Lake (Lower, Upper Thetis)	7,870	10.0	no data	5.0	2.2
McKenzie Lake (McKenzie Ponds)	1,600	216.1	125.3	16.8	8.5
Elk Lake (Elk-Beaver Lake)	9,760	37.5	33.9	7.6	3.4
Beaver Lake (Beaver-Elk Lake)	3,653	59.8	22.0	14.0	6.7
Prospect Lake	4,670	7.1	4.9	8.0	4.1
Maltby Lake	1,181	8.4	4.6	16.0	6.3
Durrance Lake	1,530	4.0	no data	19.5	8.8
Killarney Lake	914	42.5	no data	20.8	6.5
Lubbe Lake	6,401	61.2	33.3	17.0	6.5
Langford Lake	4,510	4.0	no data	7.0	1.9
Spectacle Lake	1,360	23.7	21.3	8.0	2.8
Oliphant Lake	3,661	537.0	134.0	50.0	12.0
Shawnigan Lake	25,200	6,204.3	no data	152.0	50.1
Cowichan Lake	109,700	19.3	16.6	7.5	3.5
Beaver Lake	2,500	24.1	no data	17.0	8.5
Fuller Lake	2,103	4.3	no data	7.9	4.0
Chemainus Lake (Weddle Lake, Askew Lake)	800	196.0	no data	19.2	4.1
Nanaimo Lakes (First Nanaimo Lake)	8,900	no data	44.0	15.8	no data
Fourth Lake (Fourth Nanaimo)	200	108.7	no data	20.4	11.6
Brannen Lake	4,298	62.7	no data	7.0	4.0
Westwood Lake	5,532	15.5	no data	7.0	3.4
Diver Lake	1,676	33.6	no data	14.0	6.0
Long Lake	3,780	13.4	5.9	9.0	5.7
Green Lake	1,400	6.7	6.7	4.7	2.0
Illusion Lakes	2,730	44.3	34.5	12.7	4.1
Spider Lake	7,200	189.6	133.7	17.0	9.3
St. Mary Lake	7,950	9.4	0.7	7.0	4.0
Bullocks Lake	1,300	26.9	17.6	9.1	4.5
Cusheon Lake	3,950	1.5	no data	5.2	1.8
Quarantine Lake	488	25.0	no data	5.0	2.7
Matheson Lake	3,710	7.1	5.6	9.0	3.6
Young Lake	1,383	24.9	11.0	11.5	4.7
Kemp Lake	2,525	6.5	5.4	9.4	2.8
Totals **Confirmed**	125,921	1,692.0	663.1		

(# of lakes)		(35)	(35)	(22)
	Unconfirmed	118,800 (3)	6,400.3 (2)	44.0 (1)
	Extrapolated	-	-	-
	All	**244,721 (38)**	**8,092.3 (37)**	**707.1 (23)**

Table 21 Names and physical characteristics of streams containing smallmouth bass (SMB) on Vancouver and the Gulf Islands. "No data" indicates physical characteristics for which no data were available in BC Ministry of Environment and/or Environment Canada compiled datasets

Vancouver and the Gulf Islands				
Gazetted Name (Local Name)	**Stream Order**	**Stream Magnitude**	**SMB Stream Length (km)**	**Stream Mean Discharge (m^3s^{-1})**
Colwood Creek (Glen Lake Creek)	2	2	no data	no data
Mill Stream (Hazlitt Creek)	3	7	no data	no data
Craigflower Creek	3	7	no data	0.323[22]
Prior Lake Creek	3	3	no data	no data
Colquitz River (Colquitz Creek)	3	17	no data	0.605[23]
Tod Creek	3	8	no data	no data
Durrance Creek	2	2	no data	no data
Johns Creek	2	2	no data	no data
Beaver Creek	1	1	no data	no data
Unnamed	3	7	no data	no data
Unnamed	2	4	no data	no data
Bloods Creek	1	1	no data	no data
Kinkade Creek	3	9	no data	no data
De Mamiel Creek	3	16	no data	no data
Totals (# of streams)	**Confirmed**		no data (14)	
	Unconfirmed		-	
	Extrapolated		-	
	All		**no data (14)**	

[22] Discharge data from WSC 08HA034 (March 9, 2007).
[23] Discharge data from WSC 08HA047 (March 1, 2007).

Table 22 Number of waterbodies having confirmed or unconfirmed occurrences of smallmouth bass that provide local habitat or downstream connectivity to waterbodies containing salmon and native sportfish or other native species in fisheries management regions of the BC Ministry of Environment.

Region	Local Habitat		Downstream Connectivity		Number of Smallmouth Bass Occurrences in Region
	Salmon	Native Sportfish or Other Native Species	Salmon	Native Sportfish or Other Native Species	
Vancouver Island	3	53	43	50	53
Lower Mainland	2	2	2	2	2
Thompson	-	2	1	2	2
Kootenay	*	3	*	3	3
Okanagan	2**	10	7	7	10
Cariboo	1	5	5	5	5
Total	**8**	**75**	**58**	**69**	**75**

* Migratory salmon are absent from the Kootenay Region.

** Though an ongoing experiment provides sockeye salmon access to Skaha Lake, mainstem river dams normally limit access by migratory salmon to portions of the Okanagan Region downstream of this waterbody.

Table 23 Names and record status for waterbodies containing smallmouth bass in the lower Fraser River watershed. The lowermost shared parent stream is displayed in bold text. Tributary relationships are indicated by inset text. Bold italicised text indicates an independent tributary relationship to the last preceding bold text parent stream.

Lower Fraser River Watershed		
Gazetted Name (Local Name)		**Status of Record**
Salmon River		Confirmed
Kakawa Lake		Confirmed
Totals	**Confirmed**	2
	Unconfirmed	-
	All	2

Table 24 Names and physical characteristics of lakes containing smallmouth bass in the lower Fraser River watershed. "No data" indicates physical characteristics for which no data were available in BC Ministry of Environment compiled datasets.

Lower Fraser River Watershed						
Gazetted Name (Local Name)		**Perimeter (m)**	**Surface Area (ha)**	**Littoral Area (ha)**	**Maximum Depth (m)**	**Mean Depth (m)**
Kakawa Lake		4,110	77.4	11.5	14	11.1
Totals (# of lakes)	**Confirmed**	4,110 (1)	77.4 (1)	11.5 (1)		
	Unconfirmed	-	-	-		
	Extrapolated	-	-	-		
	All	**4,110 (1)**	**77.4 (1)**	**11.5 (1)**		

Table 25 Names and physical characteristics of streams containing smallmouth bass (SMB) in the lower Fraser River watershed. "No data" indicates physical characteristics for which no data were available in BC Ministry of Environment and/or Environment Canada compiled datasets

Lower Fraser River Watershed				
Gazetted Name (Local Name)	**Stream Order**	**Stream Magnitude**	**SMB Stream Length (km)**	**Stream Mean Discharge (m^3s^{-1})**
Salmon River	4	63	no data	1.420[24]
Totals (# of streams)	**Confirmed**		no data (1)	
	Unconfirmed			
	Extrapolated			
	All		**no data (1)**	

[24] Hydrometric data for WSC station 08MH090 (June 21, 2007).

Table 26 Names and record status for waterbodies containing smallmouth bass in the South Thompson River watershed. The lowermost shared parent stream is displayed in bold text. Tributary relationships are indicated by inset text. Bold italicised text indicates an independent tributary relationship to the last preceding bold text parent stream.

South Thompson River Watershed		
Gazetted Name (Local Name)		**Status of Record**
Phillips Lake (Lake #4268)		Unconfirmed
Gardom Lake		Confirmed
Totals	**Confirmed**	1
	Unconfirmed	1
	All	2

Table 27 Names and physical characteristics of lakes containing smallmouth bass in the South Thompson River watershed. "No data" indicates physical characteristics for which no data were available in BC Ministry of Environment compiled datasets.

South Thompson River Watershed						
Gazetted Name (Local Name)		**Perimeter (m)**	**Surface Area (ha)**	**Littoral Area (ha)**	**Maximum Depth (m)**	**Mean Depth (m)**
Phillips Lake (Lake #4268)		4,000	56.0	no data	10.0	6.0
Gardom Lake		4,090	75.9	31.2	23.8	8.8
Totals (# of lakes)	**Confirmed**	4,090 (1)	75.9 (1)	31.2 (1)		
	Unconfirmed	4,000 (1)	56.0 (1)	no data (1)		
	Extrapolated	-	-	-		
	All	**8,090 (2)**	**131.9 (2)**	**31.2 (1)**		

Table 28 Names and record status for waterbodies containing smallmouth bass in the upper Columbia River (Kootenay) watershed. The lowermost of contiguous waterbodies are displayed in bold text. Tributary relationships are indicated by inset text. Bold italicised text indicates an independent tributary relationship to the last preceding bold text parent stream.

Upper Columbia River (Kootenay) Watershed		
Gazetted Name (Local Name)		**Status of Record**
Columbia River (Bush Arm)		Confirmed
Pend D'Oreille River		Confirmed
Kootenay River (Lower) (Hoder Creek Tributary)		Unconfirmed
Totals	**Confirmed**	2
	Unconfirmed	1
	All	3

Table 29 Provincial Bass/Sunfish (General) stocking records for the Kootenay watershed (BC MOE 2007c).

Gazetted Name (Local Name)	Fish Count	Source/Strain	Life Stage	Year
Fraser Lake	15	Kootenay/Kootenay	Unknown	1923
Fraser Lake	370	Kootenay/Kootenay	Fingerling	1923
Moyie Lake	150	Bay of Quinte, ON / Bay of Quinte, ON	Fry	1901

Table 30 Names and physical characteristics of streams containing smallmouth bass (SMB) in the upper Columbia River (Kootenay) watershed. "No data" indicates physical characteristics for which no data were available in BC Ministry of Environment and/or Environment Canada compiled datasets

Upper Columbia River (Kootenay) Watershed				
Gazetted Name (Local Name)	**Stream Order**	**Stream Magnitude**	**SMB Stream Length (km)**	**Stream Mean Discharge (m^3s^{-1})**
Columbia River (Bush Arm)	8	15,639	no data	2,840[25]
Pend D'Oreille River	6	420	no data	-
Kootenay River (Lower) (Hoder Creek Tributary)	7	5,257	no data	792[26]
Totals (# of streams)	**Confirmed**		no data (1)	
	Unconfirmed		no data (1)	
	Extrapolated		-	
	All		**no data (2)**	

[25] Discharge data from WSC station 08NE058 (February 14, 2007).
[26] Discharge data from WSC station 08NJ158 (February 14, 2007).

Table 31 Names and record status for waterbodies containing smallmouth bass in the lower Columbia River (Okanagan) watershed. The lowermost of contiguous waterbodies are displayed in bold text. Tributary relationships are indicated by inset text. Bold italicised text indicates an independent tributary relationship to the last preceding bold text parent stream.

Lower Columbia River (Okanagan) Watershed		
Gazetted Name (Local Name)		**Status of Record**
Okanagan River (Okanagan River Channel)		Confirmed
Osoyoos Lake		Confirmed
Vaseux Lake		Confirmed
Skaha Lake		Confirmed
Peanut Lake		Confirmed
Deadman Lake		Confirmed
Tugulnuit Lake		Confirmed
Kettle River		Confirmed
Christina Creek		Confirmed
Christina Lake		Confirmed
Totals	**Confirmed**	10
	Unconfirmed	-
	All	10

Table 32 Provincial Bass/Sunfish (General) stocking records for the Okanagan watershed (BC MOE 2007c).

Gazetted Name (Local Name)	Fish Count	Source/Strain	Life Stage	Year
Christina Lake	500	Bay of Quinte, ON / Bay of Quinte, ON	Fry	1901

Table 33 Names and physical characteristics of lakes containing smallmouth bass in the lower Columbia River (Okanagan) watershed. "No data" indicates physical characteristics for which no data were available in BC Ministry of Environment compiled datasets.

Lower Columbia River (Okanagan) Watershed						
Gazetted Name (Local Name)		**Perimeter (m)**	**Surface Area (ha)**	**Littoral Area (ha)**	**Maximum Depth (m)**	**Mean Depth (m)**
Skaha Lake		30,700	1,960.0	392.0	56.7	26.6
Vaseux Lake		10,802	274.4	no data	26.8	6.4
Osoyoos Lake		47,900	2,300.0	no data	63.0	14.0
Peanut Lake		no data	3.3	no data	no data	4.2
Deadman Lake		no data	no data	no data	no data	no data
Tugulnuit Lake		3,079	50.6	no data	8.1	5.7
Christina Lake		44,714	2,509.0	no data	53.9	36.1
Totals (# of lakes)	**Confirmed**	137,195 (5)	7,097.3 (6)	392.0 (1)		
	Unconfirmed	-	-	-		
	Extrapolated	-	-	-		
	All	**137,195 (5)**	**7,097.3 (6)**	**392.0 (1)**		

Table 34 Names and physical characteristics of streams containing smallmouth bass (SMB) in the lower Columbia River (Okanagan) watershed. "No data" indicates physical characteristics for which no data were available in BC Ministry of Environment and/or Environment Canada compiled datasets

Lower Columbia River (Okanagan) Watershed				
Gazetted Name (Local Name)	**Stream Order**	**Stream Magnitude**	**SMB Stream Length (km)**	**Stream Mean Discharge (m^3s^{-1})**
Okanagan River (Okanagan River Channel)	6	1,556	no data	15.300[27]
Kettle River	6	1,045	no data	9.600[28]
Christina Creek	5	139	no data	no data[29]
Totals (# of streams)	**Confirmed**		no data (3)	
	Unconfirmed		-	
	Extrapolated		-	
	All		**no data (3)**	

[27] Discharge data from WSC 08NM050 (February 27, 2007).
[28] Discharge data from WSC 08NN003 (March 6, 2007).
[29] Hydrometric data for WSC station 08NN003 not available from WSC website.

Table 35 Names and record status for waterbodies containing smallmouth bass in the middle Fraser River watershed. The lowermost shared parent stream is displayed in bold text. Tributary relationships are indicated by inset text. Bold italicised text indicates an independent tributary relationship to the last preceding bold text parent stream.

Middle Fraser River Watershed		
Gazetted Name (Local Name)		**Status of Record**
Beaver Creek		Confirmed
Chambers Lake		Confirmed
Opheim Lake		Confirmed
Beaver Lake		Confirmed
Lake George (George Lake)		Confirmed
Totals	**Confirmed**	5
	Unconfirmed	-
	All	5

Table 36 Names and physical characteristics of lakes containing smallmouth bass in the. middle Fraser River watershed "No data" indicates physical characteristics for which no data were available in BC Ministry of Environment compiled datasets.

Middle Fraser River Watershed						
Gazetted Name (Local Name)		**Perimeter (m)**	**Surface Area (ha)**	**Littoral Area (ha)**	**Maximum Depth (m)**	**Mean Depth (m)**
Chambers Lake		5,267	117.0	40.1	29.6	10.6
Opheim Lake		8,595	104.5	87.4	8.5	3.5
Beaver Lake		15,490	184.5	126.3	35	5.9
Lake George (George Lake)		4,709	70.8	19.5	21.6	10.3
Totals (# of lakes)	**Confirmed**	34,061 (4)	476.8 (4)	273.3 (4)		
	Unconfirmed	-	-	-		
	Extrapolated	-	-	-		
	All	**34,061 (4)**	**476.8 (4)**	**273.3 (4)**		

Table 37 Names and physical characteristics of streams containing smallmouth bass (SMB) in the middle Fraser River watershed "No data" indicates physical characteristics for which no data were available in BC Ministry of Environment and/or Environment Canada compiled datasets

Middle Fraser River Watershed					
Gazetted Name (Local Name)		**Stream Order**	**Stream Magnitude**	**SMB Stream Length (km)**	**Stream Mean Discharge (m^3s^{-1})**
Beaver Creek		6	280	55.8	no data[30]
Totals (# of streams)	**Confirmed**			55.8 (1)	
	Unconfirmed			-	
	Extrapolated			-	
	All			**55.8 (1)**	

Table 38 Names and record status for waterbodies containing largemouth bass on Vancouver Island. The lowermost of contiguous waterbodies are displayed in bold text. Tributary relationships are indicated by inset text. Bold italicised text indicates an independent tributary relationship to the last preceding bold text parent stream.

Vancouver Island		
Gazetted Name (Local Name)		**Status of Record**
Elk Lake (Elk-Beaver Lake)		Confirmed
Prospect Lake		Confirmed
Fuller Lake		Unconfirmed
Totals	**Confirmed**	2
	Unconfirmed	1
	All	3

[30] Mean annual discharge value not available for WSC station 08KH021 from WSC website. (April 2, 2007).

Table 39 Names and physical characteristics of lakes containing largemouth bass on Vancouver Island. "No data" indicates physical characteristics for which no data were available in BC Ministry of Environment compiled datasets.

Vancouver Island						
Gazetted Name (Local Name)		**Perimeter (m)**	**Surface Area (ha)**	**Littoral Area (ha)**	**Maximum Depth (m)**	**Mean Depth (m)**
Elk Lake (Elk-Beaver Lake)		9,760	216.1	125.3	16.8	8.5
Prospect Lake		4,670	59.8	22.0	14.0	6.7
Fuller Lake		2,103	24.1	no data	17.0	8.5
Totals (# of lakes)	Confirmed	14,430 (2)	275.9 (2)	147.3 (2)		
	Unconfirmed	2,103 (1)	24.1 (1)	no data (1)		
	Extrapolated	-	-	-		
	All	**16,533 (3)**	**300.0 (3)**	**147.3 (2)**		

Table 40 Number of waterbodies having confirmed or unconfirmed occurrences of largemouth bass that provide local habitat or downstream connectivity to waterbodies containing salmon and native sportfish or other native species in fisheries management regions of the BC Ministry of Environment.

Region	**Local Habitat**		**Downstream Connectivity**		**Number of Largemouth Bass Occurrences in Region**
	Salmon	**Native Sportfish or Other Native Species**	**Salmon**	**Native Sportfish or Other Native Species**	
Vancouver Island	-	3	3	3	3
Lower Mainland	31	36	43	44	50
Thompson	-	1	-	1	1
Kootenay	*	34	*	27	42
Okanagan	2**	8	6	6	9
Total	**33**	**48**	**50**	**54**	**105**

* Migratory salmon are absent from the Kootenay Region.

** Though an ongoing experiment provides sockeye salmon access to Skaha Lake, mainstem river dams normally limit access by migratory salmon to portions of the Okanagan Region downstream of this waterbody.

Table 41 Names and record status for waterbodies containing largemouth bass in the lower Fraser River watershed. The lowermost shared parent stream is displayed in bold text. Tributary relationships are indicated by inset text. Bold italicised text indicates an independent tributary relationship to the last preceding bold text parent stream.

Lower Fraser River Watershed	
Gazetted Name (Local Name)	**Status of Record**
Fraser River (The Big Eddy, Bishop's Reach)	Confirmed
Brunette River (Still Creek)	Confirmed
Burnaby Lake	Confirmed
Coquitlam River (Terry Fox Creek)	Confirmed
Pitt River (Chatham Reach, Fox Reach)	Confirmed
Pitt Lake	Confirmed
Katzie Marsh (Katzie Slough)	Confirmed
Cranberry Slough	Confirmed
Alouette River (Fenton Road Slough, South Alouette River)	Confirmed
North Alouette River	Confirmed
Partington Creek (Cedar Creek)	Confirmed
McLean Creek	Confirmed
Unnamed (Addington Marsh)	Confirmed
Sturgeon Slough	Confirmed
Unnamed (Homilk'um Marsh)	Confirmed
Catbird Slough	Confirmed
Unnamed (Smohk'wa Marsh)	Confirmed
Unnamed (Osprey Basin)	Confirmed
Unnamed (Red Slough)	Confirmed
Kanaka Creek	Confirmed
Spencer Creek	Confirmed
Salmon River	Confirmed
West Creek	Confirmed
Maya Creek	Confirmed
Stave River (Blind Slough)	Confirmed
Hayward Lake	Confirmed
Silvermere Lake	Confirmed
Sayres Lake	Confirmed
Chester Creek	Confirmed
Silverdale Creek (Silver Creek)	Confirmed
Unnamed (Silverdale Creek Pond)	Confirmed
Clayburn Creek	Confirmed
Mill Lake (Abbotsford Lake)	Confirmed
Lower Hatzic Slough (Hatzic Slough)	Confirmed
Hatzic Lake	Confirmed
Chilqua Creek (Chilqua Slough)	Confirmed
Unnamed	Confirmed
Chadsey Lake	Confirmed
Hope Slough (Hope Camp Slough, Hope River)	Confirmed

Harrison Lake		Confirmed
Nicomekl River		Confirmed
Unnamed (Barbara Creek, Barber Creek)		Confirmed
Freeman Lake		Confirmed
Lund Lake		Confirmed
Pepin Creek		Confirmed
Howes Creek		Confirmed
Fishtrap Creek		Confirmed
Laxton Lake		Confirmed
Judson Lake		Confirmed
Unnamed (Walmsley Lake)		Confirmed
Totals	Confirmed	50
	Unconfirmed	-
	All	50

Table 42 Names and physical characteristics of lakes containing largemouth bass in the lower Fraser River watershed. "No data" indicates physical characteristics for which no data were available in BC Ministry of Environment compiled datasets.

Lower Fraser River Watershed					
Gazetted Name (Local Name)	**Perimeter (m)**	**Surface Area (ha)**	**Littoral Area (ha)**	**Maximum Depth (m)**	**Mean Depth (m)**
Burnaby Lake	no data	no data	no data	3.0	no data
Pitt Lake	no data	5,382.5	no data	142.6	46.0
Unnamed (Smohk'wa Marsh)	no data	no data	no data	no data	no data
Hayward Lake	no data	276.4	47.1	38.0	15.6
Silvermere Lake	no data	no data	no data	no data	no data
Sayres Lake	4,100	78.2	59.7	84.0	47.0
Unnamed (Silverdale Creek Pond)	no data	no data	no data	no data	no data
Mill Lake (Abbotsford Lake)	2,175	18.5	1.9	11.0	2.0
Hatzic Lake	10,461	367.9	no data	16.8	2.4
Chadsey Lake	1,295	9.3	2.2	16.0	4.3
Harrison Lake	no data	21,780.0	no data	279.0	150.0
Freeman Lake	780	2.7	0.2	22.0	10.3
Lund Lake	no data	no data	no data	no data	no data
Laxton Lake	no data	no data	no data	no data	no data
Judson Lake	2,600	24.3	no data	no data	no data
Unnamed (Walmsley Lake)	no data	no data	no data	no data	no data
Totals (# of lakes) **Confirmed**	21,411 (6)	27,939.7 (9)	111.1 (5)		
Unconfirmed	-	-	-		
Extrapolated	-	-	-		
All	**21,411 (6)**	**27,939.7 (9)**	**111.1 (5)**		

Table 43 Names and physical characteristics of streams containing largemouth bass (LMB) in the lower Fraser River watershed. "No data" indicates physical characteristics for which no data were available in BC Ministry of Environment and/or Environment Canada compiled datasets

Lower Fraser River Watershed				
Gazetted Name (Local Name)	**Stream Order**	**Stream Magnitude**	**LMB Stream Length (km)**	**Stream Mean Discharge (m^3s^{-1})**
Fraser River (The Big Eddy, Bishop's Reach)	9	61,800	no data	3,340[31]
Brunette River (Still Creek)	3	19	no data	2.850[32]
Coquitlam River (Terry Fox Creek)	4	81	no data	5.600[33]
Pitt River (Chatham Reach, Fox Reach)	6	525	no data	53.300[34]
Katzie Marsh (Katzie Slough)	3	29	no data	no data
Cranberry Slough	2	3	no data	no data
Alouette River (Fenton Road Slough, South Alouette River)	5	135	no data	5.200[35]
North Alouette River	4	37	no data	2.820[36]
Partington Creek (Cedar Creek)	2	5	no data	no data
McLean Creek	2	5	no data	no data
Unnamed (Addington Marsh)	2	2	no data	no data
Sturgeon Slough	3	12	no data	no data
Unnamed (Homilk'um Marsh)	1	1	no data	no data
Catbird Slough	2	9	no data	no data
Unnamed (Osprey Basin)	1	1	no data	no data
Unnamed (Red Slough)	3	4	no data	no data
Kanaka Creek	3	34	no data	2.710[37]
Spencer Creek	2	2	no data	no data
Salmon River	4	63	no data	1.420[38]
West Creek	2	7	no data	0.394[39]
Maya Creek	1	1	no data	no data
Stave River (Blind Slough)	5	294	no data	130.000[40]
Chester Creek	2	5	no data	no data
Silverdale Creek (Silver Creek)	2	7	no data	0.795[41]
Clayburn Creek	4	16	no data	no data
Lower Hatzic Slough (Hatzic	4	42	no data	no data

[31] Hydrometric data for WSC station 08MH024 (June 27, 2007).
[32] Hydrometric data for WSC station 08MH026 (March 14, 2007).
[33] Hydrometric data for WSC station 08MH002 (June 27, 2007).
[34] Hydrometric data for WSC station 08MH017 (June 27, 2007).
[35] Hydrometric data for WSC station 08MH005 (March 22, 2007).
[36] Hydrometric data for WSC station 08MH006 (March 22, 2007).
[37] Hydrometric data for WSC station 08MH076 (April 24, 2007).
[38] Hydrometric data for WSC station 08MH090 (June 21, 2007).
[39] Hydrometric data for WSC station 08MH098 (March 23, 2007).
[40] Hydrometric data for WSC station 08MH011 (March 23, 2007).
[41] Hydrometric data for WSC station 08MH091 (March 23, 2007).

Slough)				
Chilqua Creek (Chilqua Slough)	3	6	no data	no data
Unnamed	2	2	no data	no data
Hope Slough (Hope Camp Slough, Hope River)	3	19	no data	no data
Nicomekl River	4	165	no data	1.940[42]
Unnamed (Barbara Creek, Barber Creek)	1	1	no data	no data
Pepin Creek	1	1	no data	no data
Howes Creek	2	3	no data	no data
Fishtrap Creek	3	11	no data	0.779[43]
Totals (# of streams)	**Confirmed**		no data (35)	
	Unconfirmed		-	
	Extrapolated		-	
	All		**no data (35)**	

[42] Hydrometric data for WSC station 08MH155 (March 14, 2007).
[43] Hydrometric data for WSC station 08MH153 (March 14, 2007).

Table 44 Names and record status for waterbodies containing largemouth bass in the South Thompson River watershed. The lowermost shared parent stream is displayed in bold text. Tributary relationships are indicated by inset text. Bold italicised text indicates an independent tributary relationship to the last preceding bold text parent stream.

South Thompson River Watershed		
Gazetted Name (Local Name)		**Status of Record**
Phillips Lake (Lake #4268)		Confirmed
Totals	**Confirmed**	1
	Unconfirmed	-
	All	1

Table 45 Names and physical characteristics of lakes containing largemouth bass in the South Thompson River watershed. "No data" indicates physical characteristics for which no data were available in BC Ministry of Environment compiled datasets.

South Thompson River Watershed						
Gazetted Name (Local Name)		**Perimeter (m)**	**Surface Area (ha)**	**Littoral Area (ha)**	**Maximum Depth (m)**	**Mean Depth (m)**
Phillips Lake (Lake #4268)		4,000	56.0	no data	10.0	6.0
Totals (# of lakes)	**Confirmed**	4,000 (1)	56.0 (1)	no data (1)		
	Unconfirmed	-	-	-		
	Extrapolated	-	-	-		
	All	**4,000 (1)**	**56.0 (1)**	**no data (1)**		

Table 46 Names and record status for waterbodies containing largemouth bass in the upper Columbia River (Kootenay) watershed. The lowermost of contiguous waterbodies are displayed in bold text. Tributary relationships are indicated by inset text. Bold italicised text indicates an independent tributary relationship to the last preceding bold text parent stream.

Upper Columbia River (Kootenay) Watershed	
Gazetted Name (Local Name)	**Status of Record**
Columbia River (Bush Arm, Canoe Reach)	Unconfirmed
Windermere Lake	Confirmed
Columbia Lake	Unconfirmed
Erie Lake (Beaver Lake)	Confirmed
Kootenay River (Lower) (Hoder Creek Tributary)	Confirmed
Kootenay Lake (West Arm)	Confirmed
Mirror Lake (Private Lake)	Confirmed
Fraser Lake	Confirmed
Duck Creek	Confirmed
Duck Lake	Confirmed
Leach Lake	Confirmed
Corn Creek (Sloughs)	Unconfirmed
Unnamed (Nick Slough)	Confirmed
French Slough	Confirmed
Rykerts Lake (Boundary Creek Lake)	Confirmed
Mineral Lake	Unconfirmed
Hiawatha Lake (Sandberg's Lake)	Confirmed
Unnamed (Maiden Lake)	Confirmed
Unnamed (Lost Lake)	Unconfirmed
Baynes Lake	Confirmed
Surveyors Lake (Surveyors Lake #1)	Confirmed
Unnamed (Surveyors Lake #3)	Unconfirmed
Unnamed (Surveyors Lake #2)	Unconfirmed
Blue Bottom Lake (Leadville Lake)	Confirmed
Suzanne Creek	Confirmed
Suzanne Lake (Manistee Lake)	Confirmed
Unnamed (Tie Lake Creek)	Unconfirmed
Tie Lake	Confirmed
Unnamed (Spring Lake)	Confirmed
Haha Creek	Confirmed
Bednorski Lake (Johnson Lake)	Confirmed
Unnamed (Ata Lake)	Confirmed
Haha Lake (Rothwell Lake)	Confirmed
Lund Lake	Confirmed
Jim Smith Creek (Unnamed Creek)	Unconfirmed
Jim Smith Lake	Confirmed
Saugum Lake	Confirmed
Hanson Creek (Wasa Lake Creek)	Unconfirmed

Wasa Lake (Hanson Lake, Hansen Lake)		Confirmed
Lewis Slough		Confirmed
Lewis Creek		Confirmed
Tamarack Lake (Larch Lake)		Unconfirmed
Totals	**Confirmed**	31
	Unconfirmed	11
	All	42

Table 47 Names and physical characteristics of lakes containing largemouth bass in the upper Columbia River (Kootenay) watershed. "No data" indicates physical characteristics for which no data were available in BC Ministry of Environment compiled datasets.

Upper Columbia River (Kootenay) Watershed					
Gazetted Name (Local Name)	**Perimeter (m)**	**Surface Area (ha)**	**Littoral Area (ha)**	**Maximum Depth (m)**	**Mean Depth (m)**
Windermere Lake	36,271	1,610.0	1533.0	6.4	3.4
Columbia Lake	42,184	2,573.9	no data	5.2	2.9
Erie Lake (Beaver Lake)	3,177	32.4	no data	14.3	5.1
Kootenay Lake (West Arm)	346,850	41,730.6	no data	155.0	102.2
Mirror Lake (Private Lake)	1,325	7.0	no data	18.0	5.6
Fraser Lake	no data	no data	no data	no data	no data
Duck Lake	no data	no data	no data	no data	no data
Leach Lake	no data	no data	no data	no data	no data
Rykerts Lake (Boundary Creek Lake)	no data	no data	no data	no data	no data
Mineral Lake	1,320	7.4	1.4	25.0	14.4
Hiawatha Lake (Sandberg's Lake)	845	4.1	4.1	5.2	2.6
Unnamed (Maiden Lake)	no data	no data	no data	no data	no data
Unnamed (Lost Lake)	no data	no data	no data	no data	no data
Baynes Lake	2,652	28.1	no data	15.2	7.3
Surveyors Lake (Surveyors Lake #1)	no data	22.7	no data	18.9	no data
Unnamed (Surveyors Lake #3)	579	1.6	no data	2.7	1.2
Unnamed (Surveyors Lake #2)	1,341	7.3	no data	1.8	1.0
Blue Bottom Lake (Leadville Lake)	823	3.6	no data	5.5	2.2
Suzanne Lake (Manistee Lake)	4,100	56.8	28.0	12.0	5.8
Tie Lake	no data	126.3	126.3	4.9	2.2
Unnamed (Spring Lake)	no data	no data	no data	no data	no data
Bednorski Lake (Johnson Lake)	1,333	9.6	no data	13.1	8.5
Unnamed	no data	no data	no data	no data	no data
Haha Lake (Rothwell Lake)	no data	13.8	no data	8.5	6.1
Lund Lake	1,500	9.8	5.6	18.0	6.5
Jim Smith Lake	2,359	21.5	no data	7.3	4.9
Saugum Lake	no data	no data	no data	no data	no data
Wasa Lake (Hanson Lake, Hansen Lake)	6,977	102.0	no data	13.1	3.8
Lewis Slough	no data	no data	no data	no data	no data
Tamarack Lake (Larch Lake)	2,469	35.5	no data	3.7	2.0
Totals (# of lakes) Confirmed	371,941 (11)	42168.0 (14)	164.0 (4)		
Unconfirmed	84,164 (6)	4235.7 (6)	1534.4 (2)		
Extrapolated	-	-	-		
All	**456,105 (17)**	**46403.7 (20)**	**1698.4 (6)**		

Table 48 Names and physical characteristics of streams containing largemouth bass (LMB) in the upper Columbia River (Kootenay) watershed. "No data" indicates physical characteristics for which no data were available in BC Ministry of Environment and/or Environment Canada compiled datasets

Upper Columbia River (Kootenay) Watershed				
Gazetted Name (Local Name)	**Stream Order**	**Stream Magnitude**	**LMB Stream Length (km)**	**Stream Mean Discharge ($m^3 s^{-1}$)**
Columbia River (Bush Arm, Canoe Reach)	8	15,639	no data	2,840[44]
Kootenay River (Lower) (Hoder Creek Tributary)	7	5,257	no data	792[45]
Duck Creek	4	34	no data	no data
Corn Creek (Sloughs)	4	38	no data	3.890[46]
Unnamed (Nick Slough)	1	1	no data	no data
French Slough	2	7	no data	no data
Suzanne Creek	2	3	no data	no data
Unnamed (Tie Lake Creek)	1	1	no data	no data
Haha Creek	4	14	no data	no data
Jim Smith Creek (Unnamed Creek)	3	6	no data	no data
Hanson Creek (Wasa Lake Creek)	2	8	no data	no data
Lewis Creek	2	6	no data	0.229[47]
Totals (# of streams)	**Confirmed**		no data (7)	
	Unconfirmed		no data (5)	
	Extrapolated		-	
	All		**no data (12)**	

[44] Hydrometric data for WSC station 08NE058 (February 14, 2007).
[45] Hydrometric data for WSC station 08NJ158 (February 14, 2007).
[46] Hydrometric data for WSC station 08NH068 (February 15, 2007).
[47] Hydrometric data for WSC station 08NG084 (February 15, 2007).

Table 49 Names and record status for waterbodies containing largemouth bass in the lower Columbia River (Okanagan) watershed. The lowermost of contiguous waterbodies are displayed in bold text. Tributary relationships are indicated by inset text. Bold italicised text indicates an independent tributary relationship to the last preceding bold text parent stream.

Lower Columbia River (Okanagan) Watershed		
Gazetted Name (Local Name)		**Status of Record**
Okanagan River (Okanagan River Channel)		Confirmed
Osoyoos Lake		Confirmed
Vaseux Lake		Confirmed
Skaha Lake		Confirmed
Yellow Lake		Unconfirmed
Trout Lake (Lusk Lake)		Confirmed
Shannon Lake		Confirmed
Christina Creek		Confirmed
Christina Lake		Confirmed
Totals	**Confirmed**	8
	Unconfirmed	1
	All	9

Table 50 Names and physical characteristics of lakes containing largemouth bass in the lower Columbia River (Okanagan) watershed. "No data" indicates physical characteristics for which no data were available in BC Ministry of Environment compiled datasets.

Lower Columbia River (Okanagan) Watershed						
Gazetted Name (Local Name)		**Perimeter (m)**	**Surface Area (ha)**	**Littoral Area (ha)**	**Maximum Depth (m)**	**Mean Depth (m)**
Skaha Lake		30,700	1,960.0	392.0	56.7	26.6
Vaseux Lake		10,802	274.4	no data	26.8	6.4
Osoyoos Lake		47,900	2,300.0	no data	63	14
Yellow Lake		4,549	32.5	no data	39.3	20.1
Trout Lake (Lusk Lake)		no data	no data	no data	no data	no data
Shannon Lake		1,770	18.2	no data	18.9	8.2
Christina Lake		44,714	2,509.0	no data	53.9	36.1
Totals (# of lakes)	Confirmed	135,886 (5)	7,061.6 (5)	392.0 (1)		
	Unconfirmed	4,549 (1)	32.5 (1)	no data (1)		
	Extrapolated	-	-	-		
	All	**140,435 (6)**	**7,094.1 (6)**	**392.0 (1)**		

Table 51 Names and physical characteristics of streams containing largemouth bass (LMB) in the lower Columbia River (Okanagan) watershed. "No data" indicates physical characteristics for which no data were available in BC Ministry of Environment and/or Environment Canada compiled datasets

Lower Columbia River (Okanagan) Watershed				
Gazetted Name (Local Name)	**Stream Order**	**Stream Magnitude**	**LMB Stream Length (km)**	**Stream Mean Discharge (m^3s^{-1})**
Okanagan River	6	1,556	no data	15.300[48]
Christina Creek	5	139	no data	no data[49]
Totals (# of streams)	Confirmed		no data (2)	
	Unconfirmed		-	
	Extrapolated		-	
	All		no data (2)	

[48] Hydrometric data for WSC station 08NM050 (February 27, 2007).
[49] Hydrometric data for stations on Christina Creek not available from WSC online datasets.

Table 52 Names and record status for waterbodies containing pumpkinseed on Vancouver Island. The lowermost shared parent stream is displayed in bold text. Tributary relationships are indicated by inset text. Bold italicised text indicates an independent tributary relationship to the last preceding bold text parent stream.

Vancouver Island	
Gazetted Name (Local Name)	**Status of Record**
Metchosin Creek	Confirmed
Colwood Creek (Glen Lake Creek)	Confirmed
Colwood Lake	Confirmed
Glen Lake	Confirmed
Mill Stream (Hazlitt Creek)	Confirmed
Unnamed	Confirmed
Florence Lake	Confirmed
Craigflower Creek (Deadman's Creek)	Confirmed
Pike Lake	Confirmed
Prior Lake Creek	Confirmed
Prior Lake	Confirmed
Thetis Lake (Lower, Upper Thetis Lake)	Confirmed
Colquitz River (Colquitz Creek)	Confirmed
Elk Lake (Elk-Beaver Lake)	Confirmed
Beaver Lake (Beaver-Elk Lake)	Confirmed
Swan Lake	Confirmed
Blenkinsop Lake	Confirmed
Unnamed (Cordova Bay Creek, Noble Creek)	Confirmed
Sandhill Creek (Shady Creek)	Confirmed
Unnamed	Confirmed
Tod Creek	Confirmed
Prospect Lake	Confirmed
Maltby Lake	Confirmed
Durrance Creek	Confirmed
Durrance Lake	Confirmed
Killarney Lake	Confirmed
Goldstream River	Confirmed
Langford Lake	Confirmed
Shawnigan Creek (Mill Bay Creek, Mill Stream Creek)	Confirmed
Shawnigan Lake	Confirmed
Somenos Lake	Confirmed
Fuller Lake	Confirmed
Michael Lake	Confirmed
Unnamed	Confirmed
Holden Lake	Confirmed
Unnamed	Confirmed
Nanaimo River (Thatcher Creek)	Confirmed
Unnamed	Confirmed
Beck Creek (Hong Kong Creek)	Confirmed

Chase River		Confirmed
Unnamed (Cat Stream Creek)		Confirmed
Millstone River (Millstream River)		Confirmed
Brannen Lake		Confirmed
Westwood Lake		Confirmed
Diver Lake		Confirmed
Long Lake		Confirmed
Little Qualicum River		Confirmed
Glinz Lake		Confirmed
Sproat Lake		Confirmed
Stamp River		Confirmed
Great Central Lake		Confirmed
Ash River		Confirmed
Unnamed (Moran Creek)		Confirmed
Somers Lake		Confirmed
Turtle Lake		Confirmed
Totals	**Confirmed**	55
	Unconfirmed	-
	All	55

Table 53 Names and physical characteristics of lakes containing pumpkinseed on Vancouver Island. "No data" indicates physical characteristics for which no data were available in BC Ministry of Environment compiled datasets.

Vancouver Island					
Gazetted Name (Local Name)	**Perimeter (m)**	**Surface Area (ha)**	**Littoral Area (ha)**	**Maximum Depth (m)**	**Mean Depth (m)**
Colwood Lake	1,310	0.3	0.3	5.5	2.3
Glen Lake	2,113	16.9	8.4	14.0	6.4
Florence Lake	1,716	11.9	11.9	5.5	3.3
Pike Lake	1,436	7.4	5.3	9.0	3.7
Prior Lake	1,030	5.9	no data	5.0	2.6
Thetis Lake (Lower, Upper Thetis Lake)	7,870	35.5	30.6	9.0	2.8
Elk Lake (Elk-Beaver Lake)	9,760	216.1	125.3	16.8	8.5
Beaver Lake (Beaver-Elk Lake)	3,653	37.5	33.9	7.6	3.4
Swan Lake	13,400	9.8	9.4	6.0	2.4
Blenkinsop Lake	2,234	7.2	7.2	3.5	1.7
Prospect Lake	4,670	59.8	22.0	14.0	6.7
Maltby Lake	1,181	7.1	4.9	8.0	4.1
Durrance Lake	1,530	8.4	4.6	16.0	6.3
Killarney Lake	914	4.0	no data	19.5	8.8
Langford Lake	4,510	61.2	33.3	17.0	6.5
Shawnigan Lake	25,200	537.0	134.0	50.0	12.0
Somenos Lake	4,800	101.1	38.4	6.5	4.2
Fuller Lake	2,103	24.1	no data	17.0	8.5
Michael Lake	2,960	42.7	1.8	8.0	3.6
Holden Lake	5,600	37.6	no data	605.0	4.4
Brannen Lake	4,298	108.7	no data	20.4	11.6
Westwood Lake	5,532	62.7	no data	7.0	4.0
Diver Lake	1,676	15.5	no data	7.0	3.4
Long Lake	3,780	33.6	no data	14.0	6.0
Glinz Lake	884	3.3	2.4	10.0	4.0
Sproat Lake	90,804	3,775.0	no data	195.0	74.0
Great Central Lake	82,254	5,085.0	no data	250.0	124.0
Somers Lake	1,800	16.4	12.3	6.0	4.1
Turtle Lake	2,220	16.2	11.1	10.0	4.5
Totals (# of lakes) **Confirmed**	291,238 (29)	10,347.9 (29)	497.0 (19)		
Unconfirmed	-	-	-		
Extrapolated	-	-	-		
All	291,238 (29)	10,347.9 (29)	497.0 (19)		

Table 54 Names and physical characteristics of streams containing pumpkinseed (PMB) on Vancouver Island. "No data" indicates physical characteristics for which no data were available in BC Ministry of Environment and/or Environment Canada compiled datasets

Vancouver Island				
Gazetted Name (Local Name)	**Stream Order**	**Stream Magnitude**	**PMB Stream Length (km)**	**Stream Mean Discharge (m^3s^{-1})**
Metchosin Creek	2	3	no data	no data
Colwood Creek (Glen Lake Creek)	2	2	no data	no data
Mill Stream (Hazlitt Creek)	3	7	no data	no data
Unnamed	2	2	no data	no data
Craigflower Creek (Deadman's Creek)	3	7	no data	0.323[50]
Prior Lake Creek	3	3	no data	no data
Colquitz River (Colquitz Creek)	3	17	no data	0.605[51]
Unnamed (Cordova Bay Creek, Noble Creek)	2	2	no data	no data
Sandhill Creek (Shady Creek)	2	3	no data	0.065[52]
Unnamed	1	1	no data	no data
Tod Creek	3	8	no data	no data
Durrance Creek	2	2	no data	no data
Goldstream River	3	18	no data	39.000[53]
Shawnigan Creek (Mill Bay Creek, Mill Stream Creek)	3	17	no data	2.190[54]
Unnamed	3	7	no data	no data
Unnamed	2	4	no data	no data
Nanaimo River (Thatcher Creek)	5	277	no data	12.300[55]
Unnamed	2	2	no data	no data
Beck Creek (Hong Kong Creek)	2	3	no data	no data
Chase River	3	7	no data	no data
Unnamed (Cat Stream Creek)	1	1	no data	no data
Millstone River (Millstream River)	3	18	no data	2.480[56]
Little Qualicum River	4	66	no data	8.590[57]
Stamp River	6	461	no data	59.300[58]
Ash River	5	220	no data	16.700[59]
Unnamed (Moran Creek)	3	7	no data	no data

[50] Hydrometric data for WSC station 08HA034 (March 9, 2007).
[51] Hydrometric data for WSC station 08HA047 (March 1, 2007).
[52] Hydrometric data for WSC station 08HA060 (March 15, 2007).
[53] Hydrometric data for WSC station 08ND012 (March 1, 2007).
[54] Hydrometric data for WSC station 08HA033 (March 1, 2007).
[55] Hydrometric data for WSC station 08HB092 (March 14 2007).
[56] Hydrometric data for WSC station 08HB032 (March 13 2007).
[57] Hydrometric data for WSC station 08HB004 (April 3, 2007).
[58] Hydrometric data for WSC station 08HB009 (March 9, 2007).
[59] Hydrometric data for WSC station 08HB032 (March 14, 2007).

Totals (# of streams)	**Confirmed**	no data (26)
	Unconfirmed	-
	Extrapolated	-
	All	no data (26)

Table 55 Number of waterbodies having confirmed or unconfirmed occurrences of pumpkinseed that provide local habitat or downstream connectivity to waterbodies containing salmon and native sportfish or other native species in fisheries management regions of the BC Ministry of Environment.

Region	Local Habitat		Downstream Connectivity		Number of Pumpkinseed Occurrences in Region
	Salmon	Native Sportfish or Other Native Species	Salmon	Native Sportfish or Other Native Species	
Vancouver Island	36	54	51	54	55
Lower Mainland	22	26	28	28	28
Thompson	-	3	-	2	3
Kootenay	*	9	*	13	14
Okanagan	2**	10	9	12	13
Total	**60**	**102**	**88**	**109**	**113**

* Migratory salmon are absent from the Kootenay Region.

** Though an ongoing experiment provides sockeye salmon access to Skaha Lake, mainstem river dams normally limit access by migratory salmon to portions of the Okanagan Region downstream of this waterbody.

Table 56 Names and record status for waterbodies containing pumpkinseed in the lower Fraser River watershed. The lowermost shared parent stream is displayed in bold text. Tributary relationships are indicated by inset text. Bold italicised text indicates an independent tributary relationship to the last preceding bold text parent stream.

Lower Fraser River Watershed	
Gazetted Name (Local Name)	**Status of Record**
Crescent Slough	Confirmed
Brunette River (Still Creek)	Confirmed
Trout Lake	Confirmed
Pitt Lake	Confirmed
Salmon River	Confirmed
Silvermere Lake	Confirmed
Chester Creek	Confirmed
Unnamed	Confirmed
Clayburn Creek	Confirmed
Mill Lake (Abbotsford Lake)	Confirmed
Wharton Creek	Confirmed
Sumas River	Confirmed
Chilliwack Creek (Little Chilliwack Creek)	Unconfirmed
Campbell River (Little Campbell River)	Confirmed
Unnamed	Confirmed
Unnamed	Confirmed
Unnamed	Confirmed
Unnamed	Unconfirmed
Nicomekl River	Confirmed
Serpentine River (Cub Creek, Tynehead Creek)	Confirmed
Mahood Creek (Bear Creek)	Confirmed
Latimer Creek	Confirmed
Unnamed	Confirmed
Stump Lake	Confirmed
Bertrand Creek	Confirmed
Cave Creek	Confirmed
Fishtrap Creek	Confirmed
Enns Brook	Confirmed

Totals		
	Confirmed	26
	Unconfirmed	2
	All	28

Table 57 Names and physical characteristics of lakes containing pumpkinseed in the lower Fraser River watershed. "No data" indicates physical characteristics for which no data were available in BC Ministry of Environment compiled datasets.

Lower Fraser River Watershed						
Gazetted Name (Local Name)		**Perimeter (m)**	**Surface Area (ha)**	**Littoral Area (ha)**	**Maximum Depth (m)**	**Mean Depth (m)**
Trout Lake		no data	no data	no data	1.9	no data
Pitt Lake		no data	5,382.5	no data	142.6	46.0
Silvermere Lake		no data	no data	no data	no data	no data
Unnamed		no data	no data	no data	no data	no data
Mill Lake (Abbotsford Lake)		2,175	18.5	1.9	11.0	2.0
Stump Lake		1,240	5.6	4.3	16.5	4.6
Totals (# of lakes)	**Confirmed**	3,415 (2)	5,406.6 (3)	6.2 (2)		
	Unconfirmed	-	-	-		
	Extrapolated	-	-	-		
	All	3,415 (2)	5,406.6 (3)	6.2 (2)		

Table 58 Names and physical characteristics of streams containing pumpkinseed (PMB) in the lower Fraser River watershed. "No data" indicates physical characteristics for which no data were available in BC Ministry of Environment and/or Environment Canada compiled datasets

Lower Fraser River Watershed				
Gazetted Name (Local Name)	**Stream Order**	**Stream Magnitude**	**PMB Stream Length (km)**	**Stream Mean Discharge (m^3s^{-1})**
Crescent Slough	2	3	no data	no data
Brunette River (Still Creek)	3	19	no data	2.850[60]
Salmon River	4	63	no data	1.420[61]
Chester Creek	2	5	no data	no data
Clayburn Creek	4	16	no data	no data
Wharton Creek	1	1	no data	no data
Sumas River	5	454	no data	3.270[62]
Chilliwack Creek (Little Chilliwack Creek)	3	19	no data	no data
Campbell River (Little Campbell River)	4	68	no data	98.900[63]
Unnamed	3	5	no data	no data
Unnamed	2	2	no data	no data
Unnamed	2	2	no data	no data
Unnamed	2	2	no data	no data
Nicomekl River	4	165	no data	1.940[64]
Serpentine River (Cub Creek, Tynehead Creek)	5	107	no data	0.457[65]
Mahood Creek (Bear Creek)	4	24	no data	0.825[66]
Latimer Creek	3	9	no data	no data
Unnamed	1	1	no data	no data
Bertrand Creek	4	30	no data	no data
Cave Creek	3	5	no data	no data
Fishtrap Creek	3	11	no data	0.779[67]
Enns Brook	2	2	no data	no data
Totals (# of streams)	**Confirmed**		no data (20)	
	Unconfirmed		no data (2)	
	Extrapolated		-	
	All		no data (20)	

[60] Hydrometric data for WSC station 08MH026 (March 14, 2007).
[61] Hydrometric data for WSC station 08MH090 (June 21, 2007).
[62] Hydrometric data for WSC station 08MH029 (April 26, 2007).
[63] Hydrometric data for WSC station 08HD003 (March 14, 2007).
[64] Hydrometric data for WSC station 08MH155 (March 14, 2007).
[65] Hydrometric data for WSC station 08MH060 (March 14, 2007).
[66] Hydrometric data for WSC station 08MH154 (April 26, 2007).
[67] Hydrometric data for WSC station 08MH153 (March 14, 2007).

Table 59 Names and record status for waterbodies containing pumpkinseed in the South Thompson River watershed. The lowermost shared parent stream is displayed in bold text. Tributary relationships are indicated by inset text. Bold italicised text indicates an independent tributary relationship to the last preceding bold text parent stream.

South Thompson River Watershed		
Gazetted Name (Local Name)		**Status of Record**
Skimikin Lake (Lake #4368)		Confirmed
Fleming Lake (Lake #4367)		Unconfirmed
Phillips Lake (Lake #4268)		Confirmed
Totals	**Confirmed**	2
	Unconfirmed	1
	All	3

Table 60 Names and physical characteristics of lakes containing pumpkinseed in the South Thompson River watershed. "No data" indicates physical characteristics for which no data were available in BC Ministry of Environment compiled datasets.

South Thompson River Watershed						
Gazetted Name (Local Name)		**Perimeter (m)**	**Surface Area (ha)**	**Littoral Area (ha)**	**Maximum Depth (m)**	**Mean Depth (m)**
Phillips Lake (Lake #4368)		4,000	56.0	no data	10.0	6.0
Skimikin Lake (Lake #4367)		2,867	19.5	19.5	4.5	no data
Fleming Lake (Lake #4268)		1,106	no data	no data	5.0	no data
Totals (# of lakes)	**Confirmed**	6,867 (3)	75.5 (2)	19.5 (1)		
	Unconfirmed	1,106 (1)	no data (1)	no data (1)		
	Extrapolated	-	-	-		
	All	7,973 (3)	75.5 (2)	19.5 (1)		

Table 61 Names and record status for waterbodies containing pumpkinseed in the upper Columbia River (Kootenay) watershed. The lowermost of contiguous waterbodies are displayed in bold text. Tributary relationships are indicated by inset text. Bold italicised text indicates an independent tributary relationship to the last preceding bold text parent stream.

Upper Columbia River (Kootenay) Watershed		
Gazetted Name (Local Name)		**Status of Record**
Columbia River (Bush Arm)		Confirmed
Windermere Lake		Confirmed
Columbia Lake		Confirmed
Beaver Creek		Confirmed
Unnamed (7 Mile Reservoir, Pend D'Oreille River)		Confirmed
Nine Mile Creek		Confirmed
Charbonneau Creek		Confirmed
Russian Creek		Confirmed
Kootenay Lake (West Arm)		Confirmed
Duck Lake		Confirmed
Unnamed (Mawson Lake, Rykerts Lake)		Confirmed
Lake Koocanusa (Libby Reservoir)		Confirmed
Linklater Creek		Confirmed
Lewis Slough		Unconfirmed
Totals	**Confirmed**	13
	Unconfirmed	1
	All	14

Table 62 Names and physical characteristics of lakes containing pumpkinseed in the upper Columbia River (Kootenay) watershed. "No data" indicates physical characteristics for which no data were available in BC Ministry of Environment compiled datasets.

Upper Columbia River (Kootenay) Watershed					
Gazetted Name (Local Name)	**Perimeter (m)**	**Surface Area (ha)**	**Littoral Area (ha)**	**Maximum Depth (m)**	**Mean Depth (m)**
Windermere Lake	36,271	1,610.0	1,533.0	6.4	3.4
Columbia Lake	42,184	2,573.9	no data	5.2	2.9
Unnamed (7 Mile Reservoir, Pend D'Oreille River)	no data	no data	no data	no data	no data
Kootenay Lake (West Arm)	346,850	41,730.6	no data	155.0	102.2
Duck Lake	no data	no data	no data	no data	no data
Unnamed (Mawson Lake, Rykerts Lake)	1,560	5.9	5.9	4.4	3.0
Lake Koocanusa (Libby Reservoir)	no data	no data	no data	no data	no data
Lewis Slough	no data	no data	no data	no data	no data
Totals (# of lakes) **Confirmed**	426,865 (4)	45,920.4 (4)	1,538.9 (2)		
Unconfirmed	no data (1)	no data (1)	no data (1)		
Extrapolated	-	-	-		
All	426,865 (4)	45,920.4 (4)	1,538.9 (2)		

Table 63 Names and physical characteristics of streams containing pumpkinseed (PMB) in the upper Columbia River (Kootenay) watershed. "No data" indicates physical characteristics for which no data were available in BC Ministry of Environment and/or Environment Canada compiled datasets

Upper Columbia River (Kootenay) Watershed				
Gazetted Name (Local Name)	**Stream Order**	**Stream Magnitude**	**PMB Stream Length (km)**	**Stream Mean Discharge (m^3s^{-1})**
Columbia River (Bush Arm)	8	15,639	no data	2,840[68]
Beaver Creek	4	67	no data	3.310[69]
Nine Mile Creek	1	1	no data	no data
Charbonneau Creek	2	3	no data	no data
Russian Creek	2	2	no data	no data
Linklater Creek	4	26	no data	no data
Totals (# of streams)	**Confirmed**		no data (6)	
	Unconfirmed		-	
	Extrapolated		-	
	All		no data (6)	

[68] Hydrometric data for WSC station 08NE058 (February 14, 2007).
[69] Hydrometric data for WSC station 08NE106 (March 15, 2007).

Table 64 Names and record status for waterbodies containing pumpkinseed in the lower Columbia River (Okanagan) watershed. The lowermost of contiguous waterbodies are displayed in bold text. Tributary relationships are indicated by inset text. Bold italicised text indicates an independent tributary relationship to the last preceding bold text parent stream.

Lower Columbia River (Okanagan) Watershed		
Gazetted Name (Local Name)		**Status of Record**
Okanagan River (Okanagan River Channel)		Confirmed
Osoyoos Lake		Confirmed
Vaseux Lake		Confirmed
Skaha Lake		Confirmed
Okanagan Lake		Confirmed
Unnamed		Confirmed
Kalamalka Lake (Long Lake)		Unconfirmed
B.X. Creek		Unconfirmed
Swan Lake (Vernon Lake)		Confirmed
Christina Lake		Unconfirmed
Angelo Creek		Unconfirmed
Unnamed (Marshall Lake, Providence Lake)		Confirmed
Glenside Creek		Unconfirmed
Totals	**Confirmed**	8
	Unconfirmed	5
	All	13

Table 65 Names and physical characteristics of lakes containing pumpkinseed in the lower Columbia River (Okanagan) watershed. "No data" indicates physical characteristics for which no data were available in BC Ministry of Environment compiled datasets.

Lower Columbia River (Okanagan) Watershed						
Gazetted Name (Local Name)		**Perimeter (m)**	**Surface Area (ha)**	**Littoral Area (ha)**	**Maximum Depth (m)**	**Mean Depth (m)**
Okanagan Lake		268,564	34,441.0	no data	242.0	75.0
Skaha Lake		30,700	1,960.0	392.0	56.7	26.6
Vaseux Lake		10,802	274.4	no data	26.8	6.4
Osoyoos Lake		47,900	2,300.0	no data	63.0	14.0
Kalamalka Lake (Long Lake)		42,400	2,590.0	no data	142.0	59.0
Swan Lake (Vernon Lake)		11,280	438.3	227.9	9.0	5.6
Christina Lake		44,714	2,509.0	no data	53.9	36.1
Unnamed (Marshall Lake, Providence Lake)		no data	no data	no data	no data	no data
Totals (# of lakes)	**Confirmed**	369,246 (5)	39,413.67 (5)	619.85 (2)		
	Unconfirmed	87,114 (2)	5,098.99 (2)	no data (2)		
	Extrapolated	-	-	-		
	All	456,360 (7)	44,512.66 (7)	619.85 (2)		

Table 66 Names and physical characteristics of streams containing pumpkinseed (PMB) in the lower Columbia River (Okanagan) watershed. "No data" indicates physical characteristics for which no data were available in BC Ministry of Environment and/or Environment Canada compiled datasets

Lower Columbia River (Okanagan) Watershed					
Gazetted Name (Local Name)	**Stream Order**	**Stream Magnitude**	**PMB Stream Length (km)**	**Stream Mean Discharge (m^3s^{-1})**	
Okanagan River	6	1556	no data	15.300[70]	
Unnamed	2	4	no data	no data	
B.X. Creek	3	26	no data	0.258[71]	
Angelo Creek	1	1	no data	no data	
Glenside Creek	2	2	no data	no data	
Totals (# of streams)	**Confirmed**		no data (2)		
	Unconfirmed		no data (3)		
	Extrapolated		-		
	All		no data (5)		

[70] Hydrometric data for WSC station 08NM050 (February 27, 2007).
[71] Hydrometric data for WSC station 08NM123 (November 30, 2007).

Table 67 Names and record status for waterbodies containing non-native walleye in the upper Columbia River (Kootenay) watershed. The lowermost of contiguous waterbodies are displayed in bold text. Tributary relationships are indicated by inset text. Bold italicised text indicates an independent tributary relationship to the last preceding bold text parent stream.

Upper Columbia River (Kootenay) Watershed		
Gazetted Name (Local Name)		**Status of Record**
Columbia River (Bush Arm, Canoe Reach)		Confirmed
Pend D'Oreille River		Confirmed
Kootenay River (Lower) (Hoder Creek Tributary)		Confirmed
Totals	**Confirmed**	3
	Unconfirmed	-
	All	3

Table 68 Names and physical characteristics of streams containing non-native walleye (WP) in the upper Columbia River (Kootenay) watershed. "No data" indicates physical characteristics for which no data were available in BC Ministry of Environment and/or Environment Canada compiled datasets

Upper Columbia River (Kootenay) Watershed				
Gazetted Name (Local Name)	**Stream Order**	**Stream Magnitude**	**WP Stream Length (km)**	**Stream Mean Discharge (m^3s^{-1})**
Columbia River (Bush Arm, Canoe Reach)	8	15,639	no data	2,840[72]
Pend D'Oreille River	6	420	no data	no data
Kootenay River (Lower) (Hoder Creek Tributary)	7	5,257	no data	792[73]
Totals (# of streams)	**Confirmed**		no data (3)	
	Unconfirmed		-	
	Extrapolated		-	
	All		no data (3)	

[72] Hydrometric data for WSC station 08NE058 (February 14, 2007).
[73] Hydrometric data for WSC station 08NJ158 (February 14, 2007).

Table 69 Names and record status for waterbodies containing non-native walleye in the lower Columbia River (Okanagan) watershed. The lowermost of contiguous waterbodies are displayed in bold text. Tributary relationships are indicated by inset text. Bold italicised text indicates an independent tributary relationship to the last preceding bold text parent stream.

Lower Columbia River (Okanagan) Watershed		
Gazetted Name (Local Name)		**Status of Record**
Kettle River		Confirmed
Christina Lake		Confirmed
Totals	**Confirmed**	2
	Unconfirmed	-
	All	2

Table 70 Names and physical characteristics of lakes containing non-native walleye in the lower Columbia River (Okanagan) watershed. "No data" indicates physical characteristics for which no data were available in BC Ministry of Environment compiled datasets.

Lower Columbia River (Okanagan) Watershed						
Gazetted Name (Local Name)		**Perimeter (m)**	**Surface Area (ha)**	**Littoral Area (ha)**	**Maximum Depth (m)**	**Mean Depth (m)**
Christina Lake		44,714	2,509.0	no data	53.9	36.1
Totals (# of lakes)	**Confirmed**	44,714 (1)	2,509.0 (1)	no data (1)		
	Unconfirmed	-	-	-		
	Extrapolated	-	-	-		
	All	44,714 (1)	2,509.0 (1)	no data (1)		

Table 71 Names and physical characteristics of streams containing non-native walleye (WP) in the lower Columbia River (Okanagan) watershed. "No data" indicates physical characteristics for which no data were available in BC Ministry of Environment and/or Environment Canada compiled datasets

Lower Columbia River (Okanagan) Watershed				
Gazetted Name (Local Name)	**Stream Order**	**Stream Magnitude**	**WP Stream Length (km)**	**Stream Mean Discharge (m^3s^{-1})**
Kettle River	6	1,045	no data	9.600[74]
Totals (# of streams)	**Confirmed**		no data (1)	
	Unconfirmed		-	
	Extrapolated		-	
	All		no data (1)	

Table 72 Number of waterbodies having confirmed or unconfirmed occurrences of non-native walleye that provide local habitat or downstream connectivity to waterbodies containing salmon and native sportfish or other native species in fisheries management regions of the BC Ministry of Environment.

Region	Local Habitat		Downstream Connectivity		Number of Walleye Occurrences in Region
	Salmon	Native Sportfish or Other Native Species	Salmon	Native Sportfish or Other Native Species	
Kootenay	*	3	*	3	3
Okanagan	*	2	*	2	2
Total	-	**5**	-	**5**	**5**

* Migratory salmon are absent from the Kootenay and Peace Regions and the Kettle River portion of the Okanagan Region.

[74] Hydrometric data for WSC station 08NN003 not available from WSC website (March 6, 2007).

Table 73 Names and record status for waterbodies containing non-native northern pike in the upper Columbia River (Kootenay) watershed. The lowermost of contiguous waterbodies are displayed in bold text. Tributary relationships are indicated by inset text. Bold italicised text indicates an independent tributary relationship to the last preceding bold text parent stream.

Upper Columbia River (Kootenay) Watershed		
Gazetted Name (Local Name)		**Status of Record**
Kootenay River (Lower) (Hoder Creek Tributary)		Confirmed
Haha Lake (Rothwell Lake)		Confirmed
Totals	**Confirmed**	2
	Unconfirmed	-
	All	2

Table 74 Names and physical characteristics of lakes containing non-native northern pike in the upper Columbia River (Kootenay) watershed. "No data" indicates physical characteristics for which no data were available in BC Ministry of Environment compiled datasets.

Upper Columbia River (Kootenay) Watershed						
Gazetted Name (Local Name)		**Perimeter (m)**	**Surface Area (ha)**	**Littoral Area (ha)**	**Maximum Depth (m)**	**Mean Depth (m)**
Haha Lake (Rothwell Lake)		no data	13.8	no data	8.5	6.1
Totals (# of lakes)	**Confirmed**	no data (1)	13.8 (1)	no data (1)		
	Unconfirmed	-	-	-		
	Extrapolated	-	-	-		
	All	no data (1)	13.8 (1)	no data (1)		

Table 75 Names and physical characteristics of streams containing non-native northern pike (NP) in the upper Columbia River (Kootenay) watershed. "No data" indicates physical characteristics for which no data were available in BC Ministry of Environment and/or Environment Canada compiled datasets

Upper Columbia River (Kootenay) Watershed				
Gazetted Name (Local Name)	**Stream Order**	**Stream Magnitude**	**NP Stream Length (km)**	**Stream Mean Discharge (m^3s^{-1})**
Kootenay River (Lower) (Hoder Creek Tributary)	7	5,257	no data	792[75]
Totals (# of streams)	**Confirmed**		no data (1)	
	Unconfirmed		-	
	Extrapolated		-	
	All		no data (1)	

Table 76 Number of waterbodies having confirmed or unconfirmed occurrences of non-native northern pike that provide local habitat or downstream connectivity to waterbodies containing salmon and native sportfish or other native species in fisheries management regions of the BC Ministry of Environment.

Region	Local Habitat		Downstream Connectivity		Number of Northern Pike Occurrences in Region
	Salmon	Native Sportfish or Other Native Species	Salmon	Native Sportfish or Other Native Species	
Kootenay	*	2	*	2	2
Total	-	**2**	-	**2**	**2**

* Migratory salmon are absent from the Kootenay Region.

[75] Hydrometric data for WSC station 08NJ158 (February 14, 2007).

Table 77 Number of confirmed and unconfirmed smallmouth bass (SMB), largemouth bass (LMB) and pumpkinseed (PMB) occurrence records located within geographically, physically or hydrologically isolated lakes, small lake groups and directly associated inlet and outlet streams in six fisheries management regions of the BC Ministry of Environment (BC MOE).

Species	BC MOE Region (Number of isolated records (total number of records))					
	Vancouver Island	Lower Mainland	Thompson	Kootenay	Okanagan	Cariboo
SMB	53 (53)	2 (2)	2 (2)	0 (3)	1 (10)	4 (4)[76]
LMB	3 (3)	5 (50)	1 (1)	34 (42)	4 (9)	-
PMB	55 (55)	11 (28)	3 (3)	5 (14)	9 (13)	-

Table 78 Cumulative number of dated occurrence records for yellow perch (YP), smallmouth bass (SMB), largemouth bass (LMB), pumpkinseed (PMB), walleye (WP) and northern pike (NP) in BC from Hatfield and Pollard (2006).

Species	Total Number of Dated Occurrences to 1950	Total Number of Dated Occurrences to 1975	Total Number of Dated Occurrences to 2005	Total Number of Occurrences in Dataset
YP	-	10	31	51
SMB	2	19	33	50
LMB	1	8	41	71
PMB	1	19	66	86

[76] Though these four waterbodies include a common freshwater parent stream, they are geographically isolated from other occurrence records for smallmouth bass in BC.

Table 79 Chemical treatment dates and first post-treatment observation dates for yellow perch (YP), smallmouth bass (SMB), largemouth bass (LMB), pumpkinseed (PMB), walleye (WP) and northern pike (NP) in BC lakes. Unrecorded first observation dates are recorded as not specified (NS).

Gazetted Name	Treatment Date	Species (First Post-treatment Observation Date)
Deadman Lake	1962	SMB (1987), YP (1987)
Durrance Lake	1958	SMB (1973), PMB (1981)
Erie Lake	1954	YP (NS)
Florence lake	1960	PMB (1973), SMB (1984), YP (NS)
Forest Lake	1972	YP (2005)
Fuller Lake	1958	SMB (NS), LMB (NS), PMB (NS)
Gallagher Lake	1956	YP (NS)
Gardom Lake	1972	YP (NS), SMB (NS)
Glen Lake	1959	PMB (1981)
Glinz Lake	1958	PMB (NS)
Hiawatha Lake	1956	YP (NS)
Kakawa Lake	1960	SMB (2003)
Langford lake	1960	YP (1999), SMB (1973), PMB (1972)
Little Pinaus Lake	1958	YP (NS)
Mill Lake	1953-1968	LMB (1996), PMB (1980)
Pinaus Lake	1958	YP (NS)
Prospect Lake	Unknown	YP (NS), SMB (1973), LMB (NS), PMB (1973)
Tugulnuit Lake	1957	SMB (NS)
Unnamed (Marshall Lake, Providence Lake)	1958	PMB (1984)
Unnamed (Unnamed)[77]	Unknown	PMB (NS)
Williamson Lake	1950	YP (NS)

[77] Watershed Code: 100-051900; Waterbody ID: 00946LFRA

FIGURES

Figure 1 Confirmed and unconfirmed occurrence records of yellow perch in British Columbia as of November 2007.

FIGURES

Figure 1 Confirmed and unconfirmed occurrence records of yellow perch in British Columbia as of November 2007.

Figure 2 Confirmed, unconfirmed and extrapolated occurrence records of yellow perch on Vancouver and the Gulf Islands (Vancouver Island Region) of British Columbia as of November 2007.

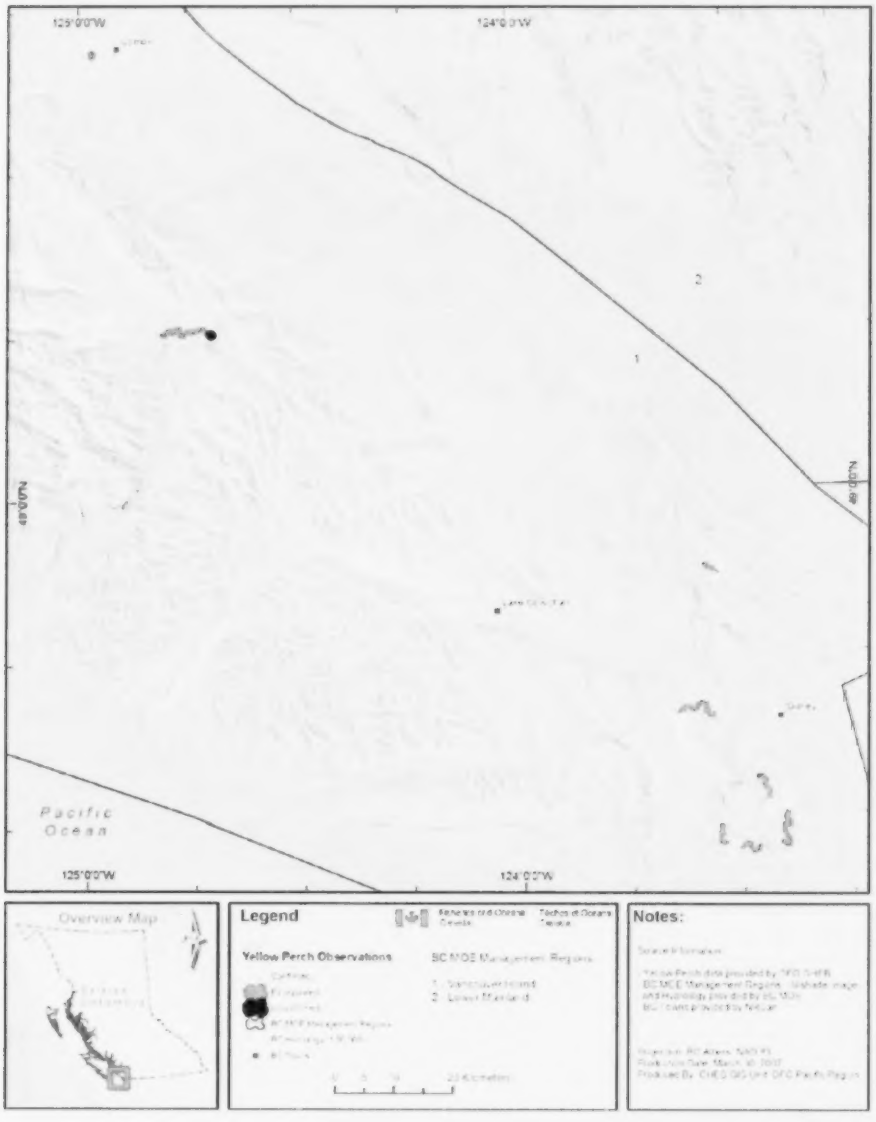


Figure 3 Confirmed, unconfirmed and extrapolated occurrence records of yellow perch in the lower Fraser River watershed (Lower Mainland Region) of British Columbia as of November 2007.

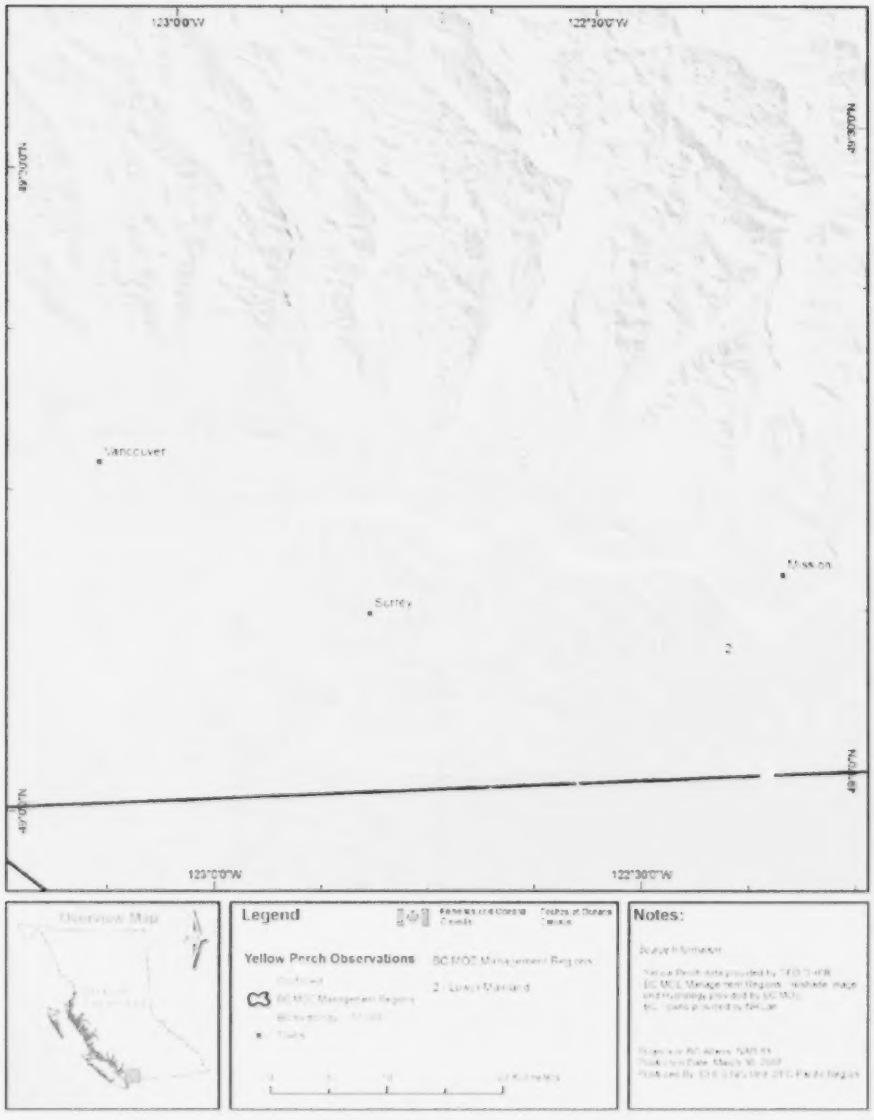


Figure 2 Confirmed, unconfirmed and extrapolated occurrence records of yellow perch on Vancouver and the Gulf Islands (Vancouver Island Region) of British Columbia as of November 2007.

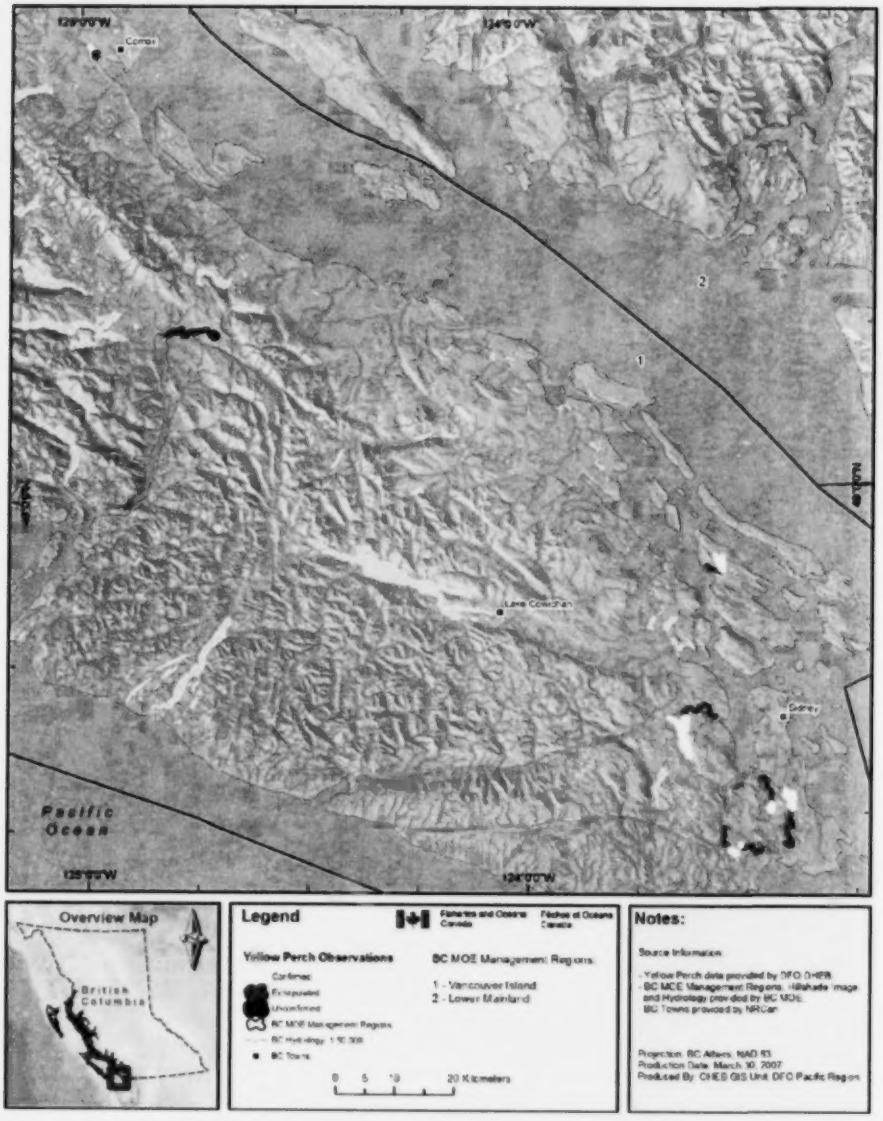


Figure 3 Confirmed, unconfirmed and extrapolated occurrence records of yellow perch in the lower Fraser River watershed (Lower Mainland Region) of British Columbia as of November 2007.

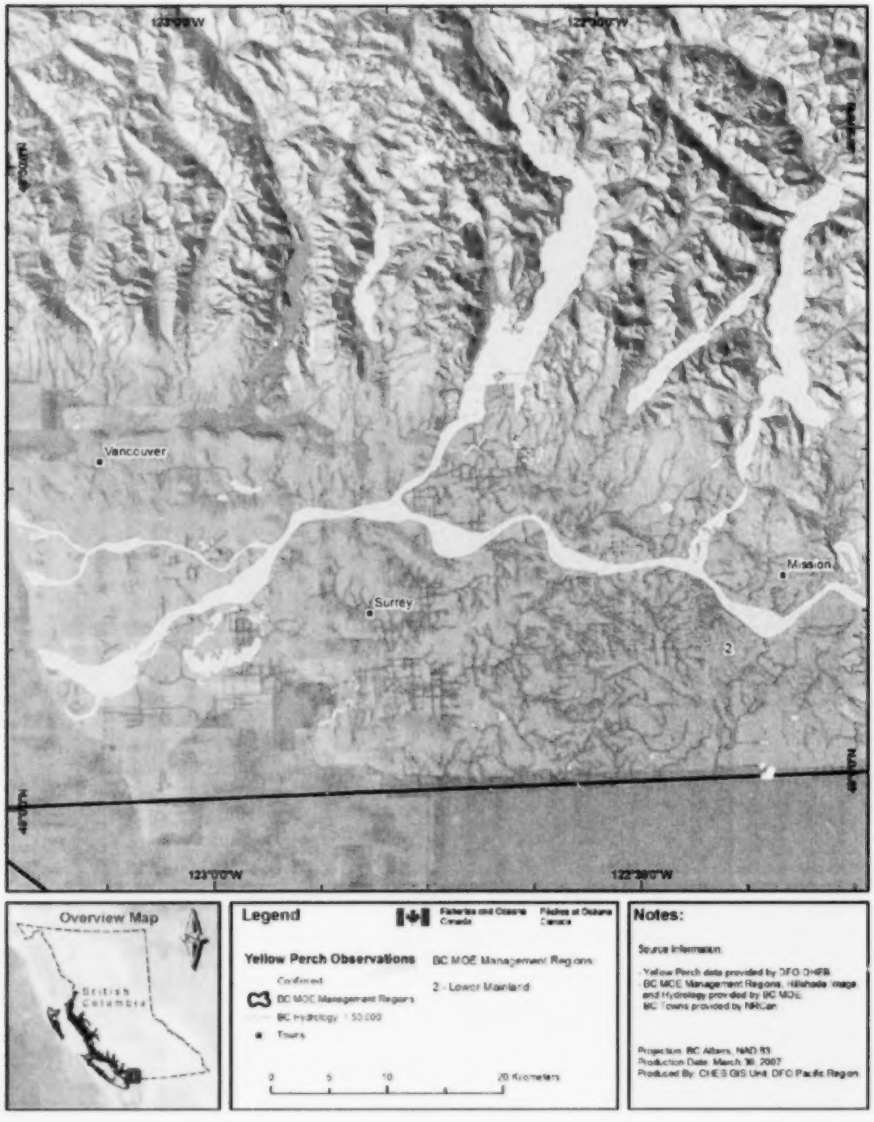


Figure 4 Confirmed, unconfirmed and extrapolated occurrence records of yellow perch in the South Thompson River watershed (Thompson Region) of British Columbia as of November 2007.

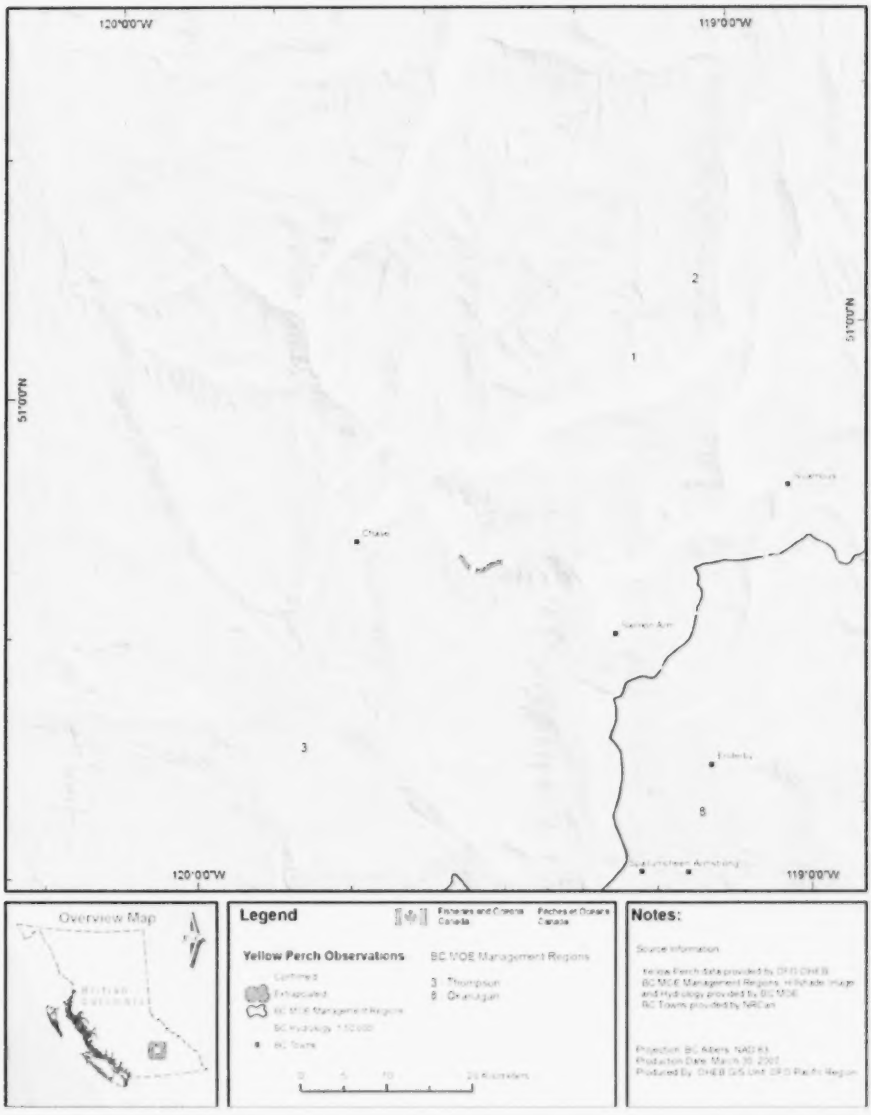


Figure 5 Confirmed, unconfirmed and extrapolated occurrence records of yellow perch over western sections of the upper Columbia River (Kootenay) watershed (Kootenay Region) of British Columbia as of November 2007.

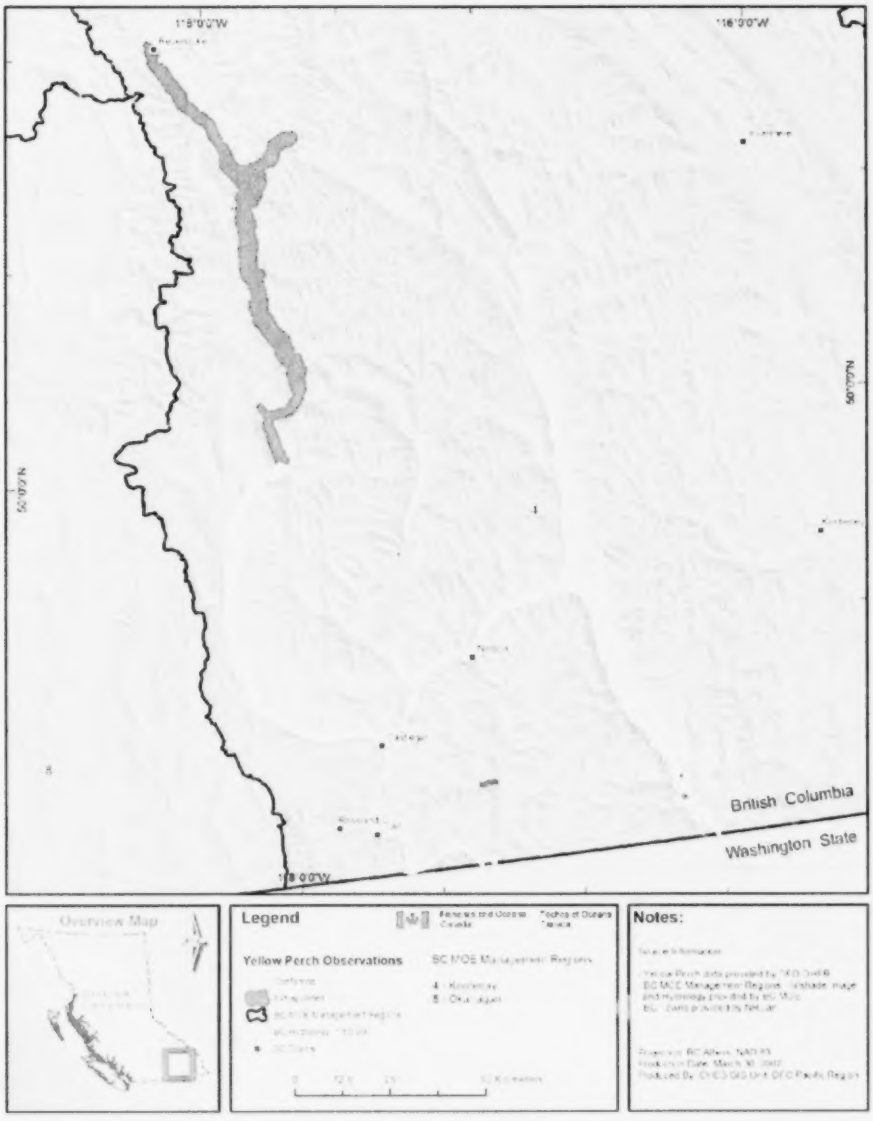


Figure 4 Confirmed, unconfirmed and extrapolated occurrence records of yellow perch in the South Thompson River watershed (Thompson Region) of British Columbia as of November 2007.

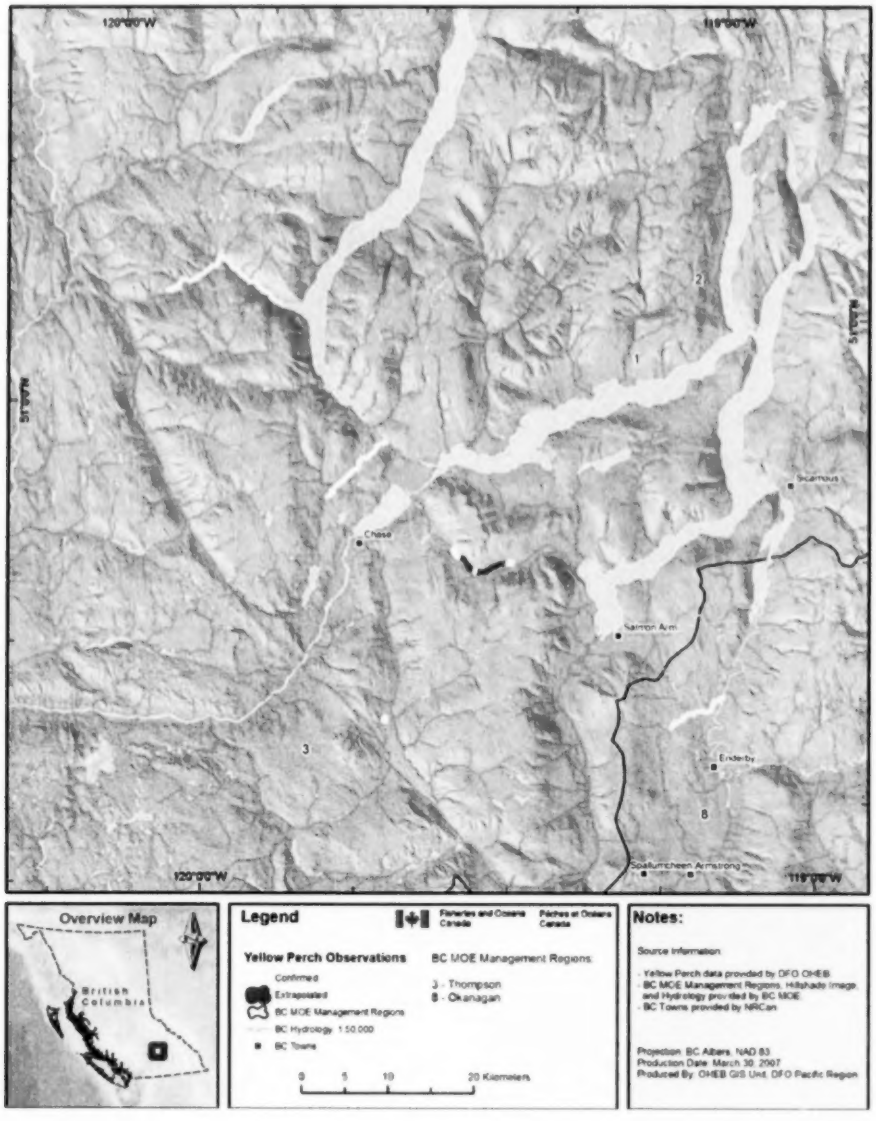


Figure 5 Confirmed, unconfirmed and extrapolated occurrence records of yellow perch over western sections of the upper Columbia River (Kootenay) watershed (Kootenay Region) of British Columbia as of November 2007.

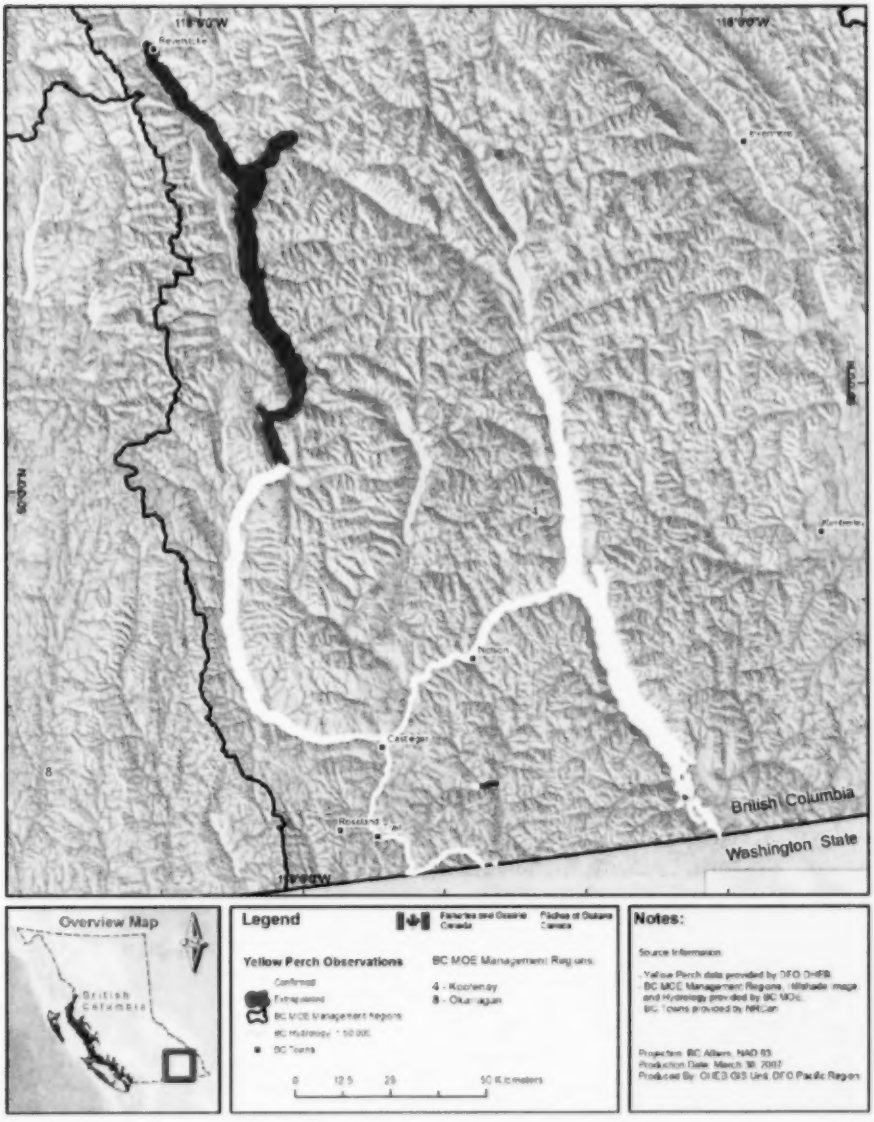


Figure 6 Confirmed, unconfirmed and extrapolated occurrence records of yellow perch over eastern sections of the upper Columbia River (Kootenay) watershed (Kootenay Region) of British Columbia as of November 2007.

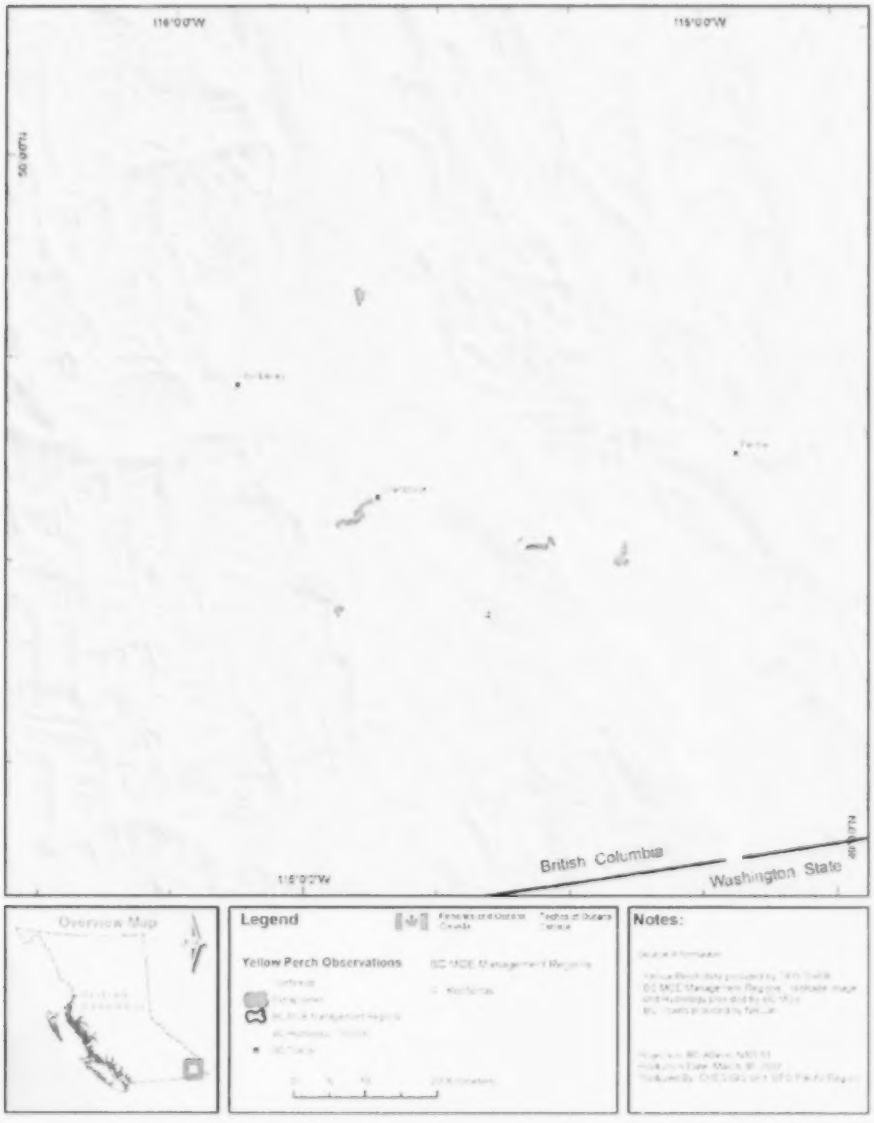


Figure 7 Confirmed, unconfirmed and extrapolated occurrence records of yellow perch in the Lower Columbia River (Okanagan) Watershed (Okanagan Region) of British Columbia as of November 2007.

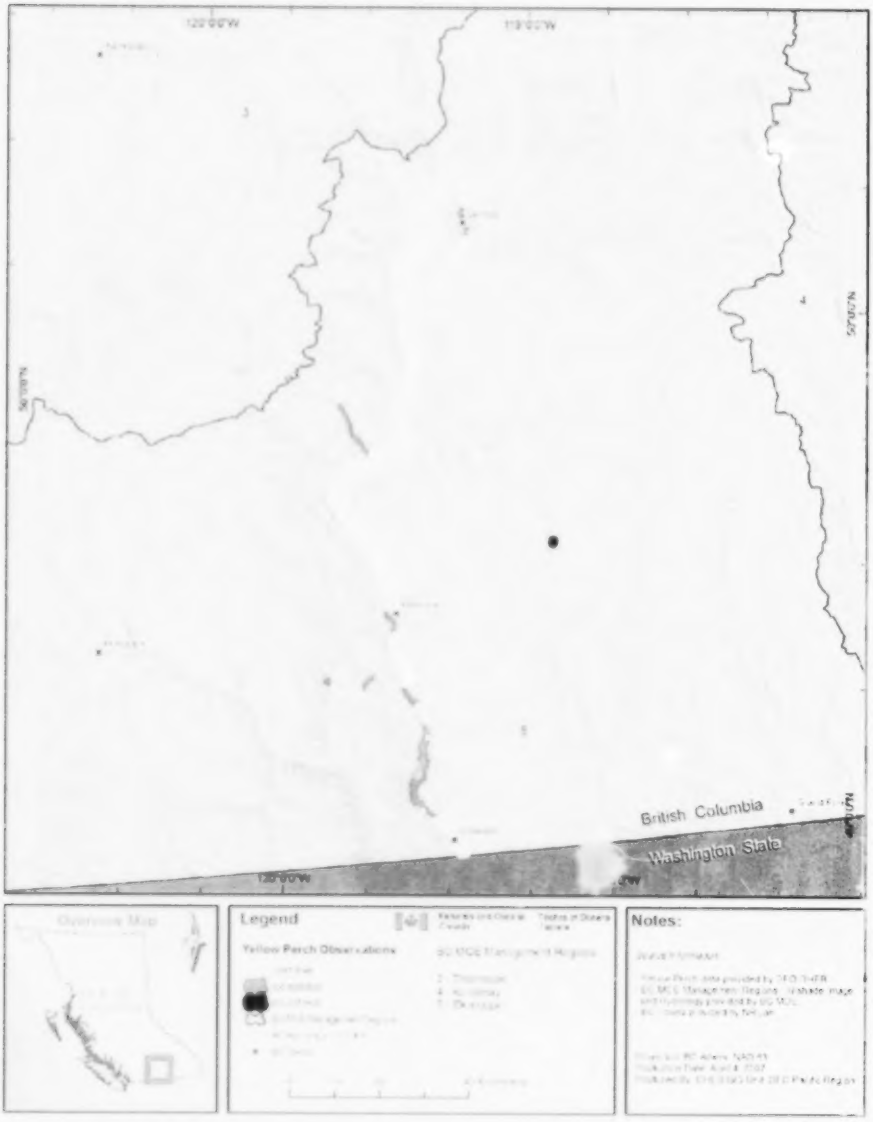


Figure 6 Confirmed, unconfirmed and extrapolated occurrence records of yellow perch over eastern sections of the upper Columbia River (Kootenay) watershed (Kootenay Region) of British Columbia as of November 2007.

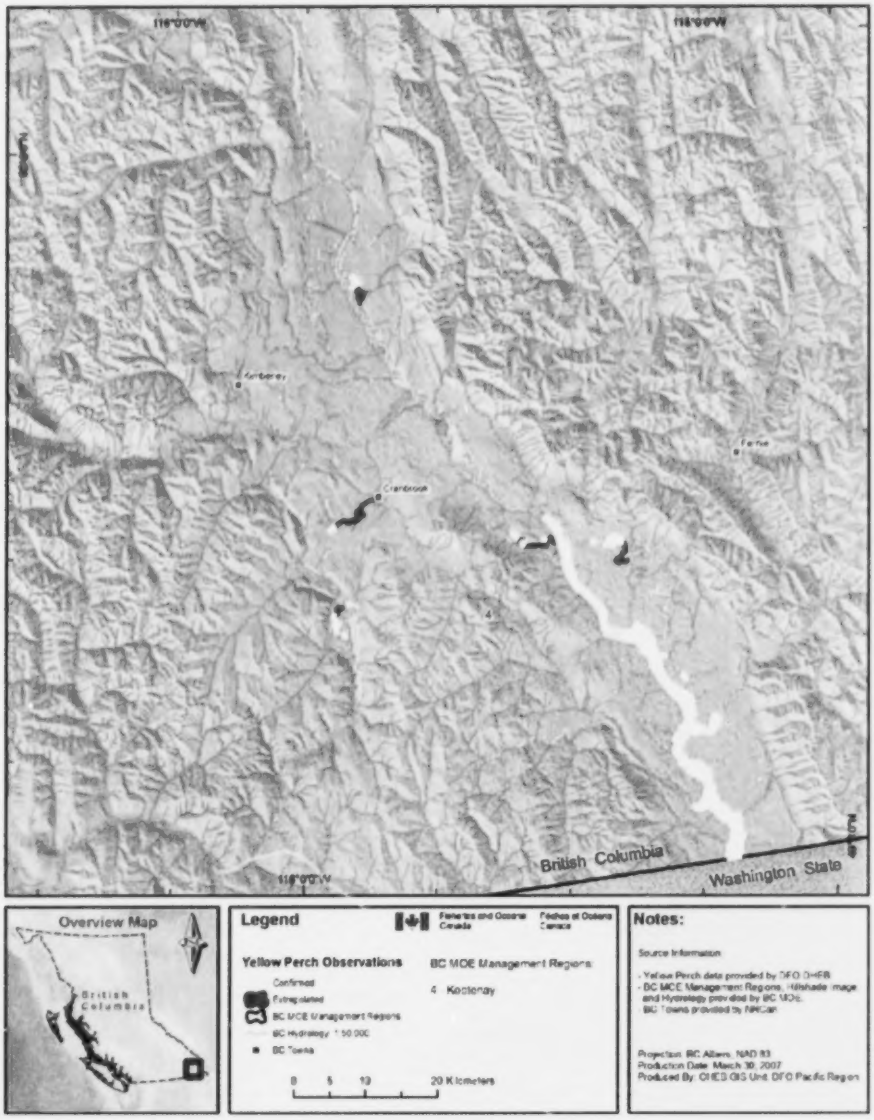


Figure 7 Confirmed, unconfirmed and extrapolated occurrence records of yellow perch in the Lower Columbia River (Okanagan) Watershed (Okanagan Region) of British Columbia as of November 2007.

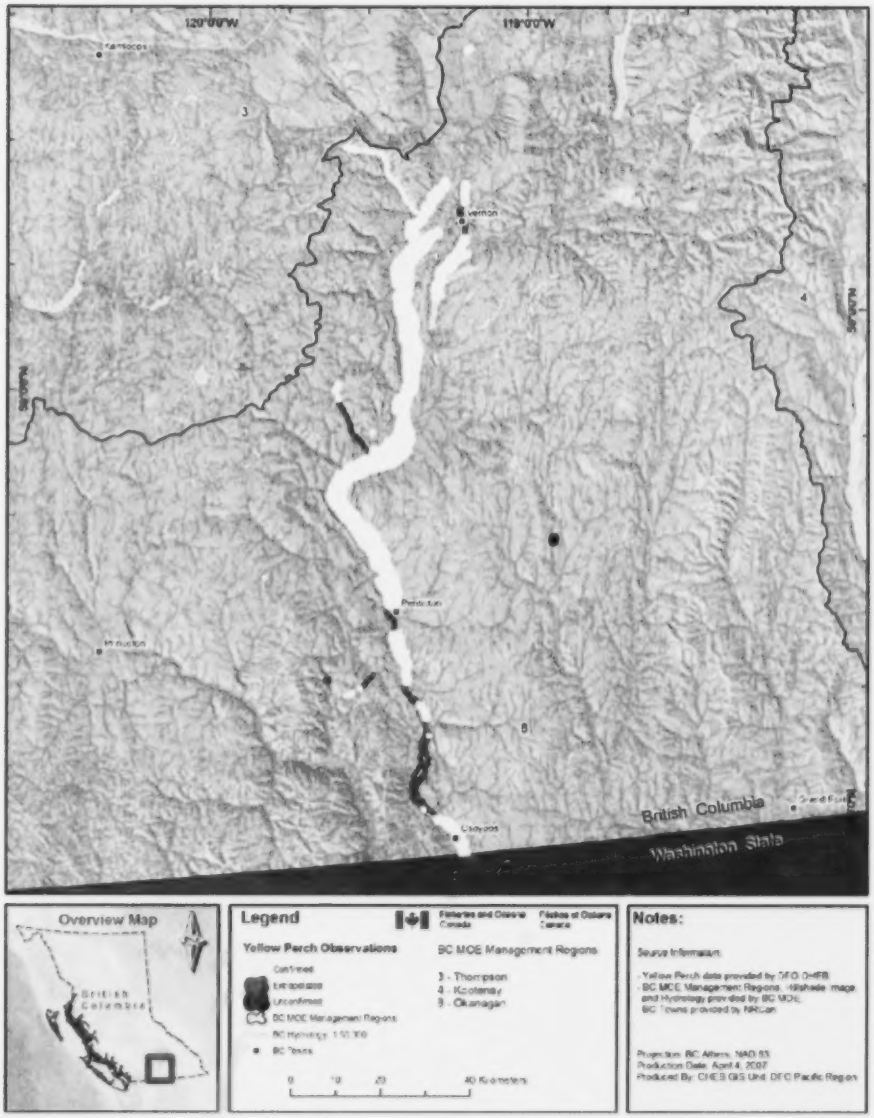


Figure 8 Confirmed, unconfirmed and extrapolated occurrence records of yellow perch in the Peace River watershed (Peace Region) of British Columbia as of November 2007

Figure 9 Confirmed and unconfirmed occurrence records of smallmouth bass in British Columbia as of March 2008.

Figure 8 Confirmed, unconfirmed and extrapolated occurrence records of yellow perch in the Peace River watershed (Peace Region) of British Columbia as of November 2007

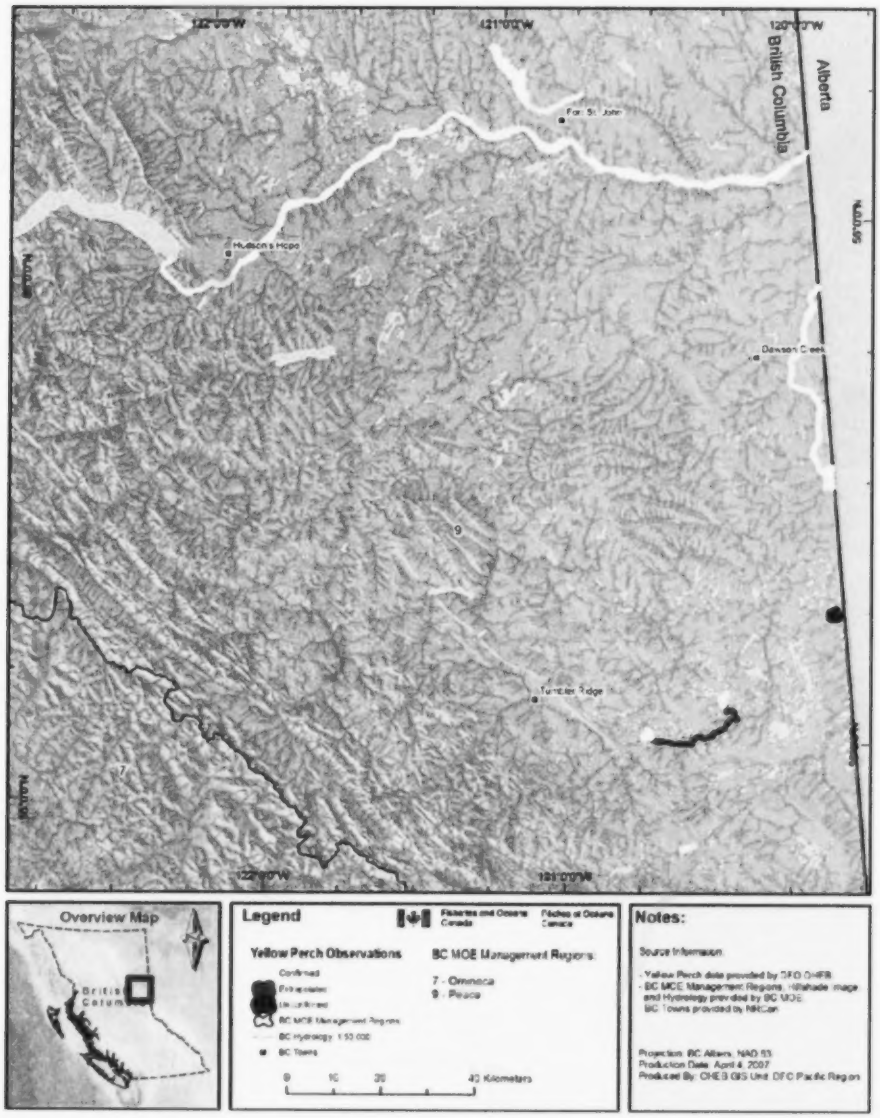


Figure 9 Confirmed and unconfirmed occurrence records of smallmouth bass in British Columbia as of March 2008.

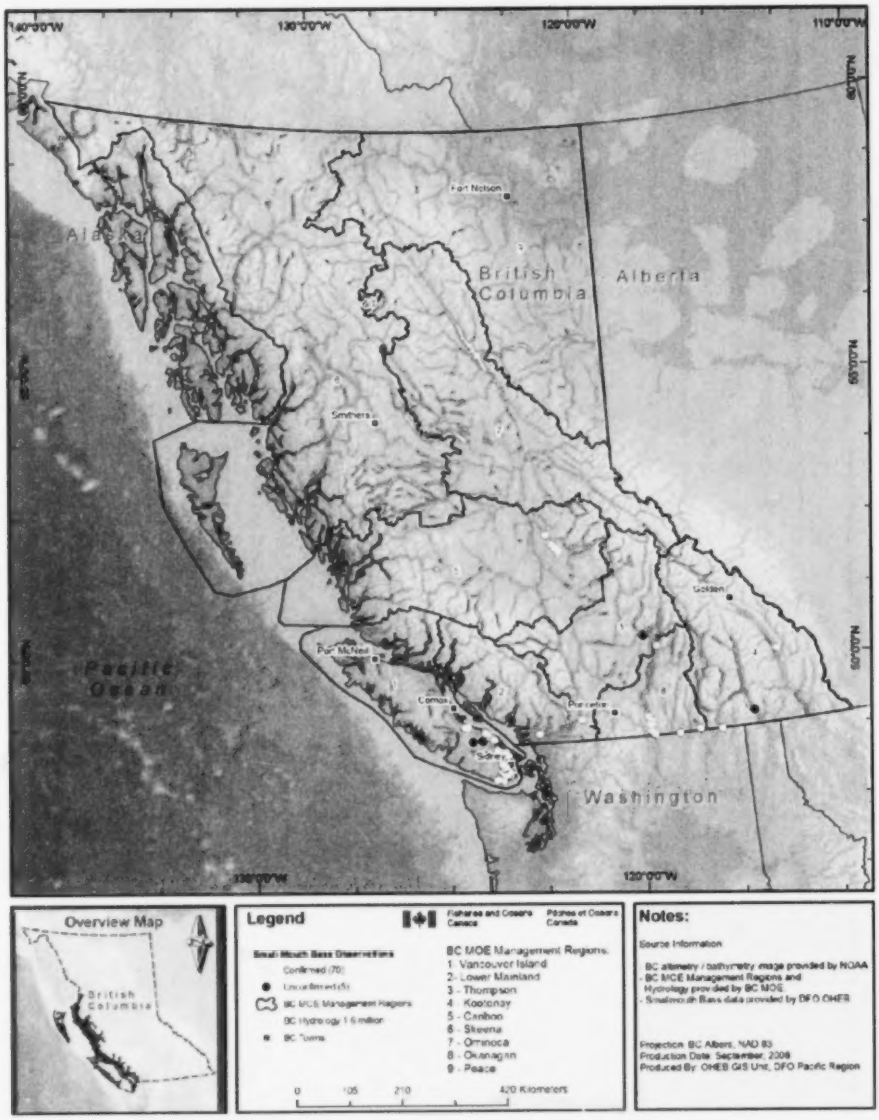


Figure 10 Confirmed and unconfirmed occurrence records of largemouth bass in British Columbia as of November 2007.

Figure 11 Confirmed and unconfirmed occurrence records of pumpkinseed in British Columbia as of November 2007.

Figure 10 Confirmed and unconfirmed occurrence records of largemouth bass in British Columbia as of November 2007.

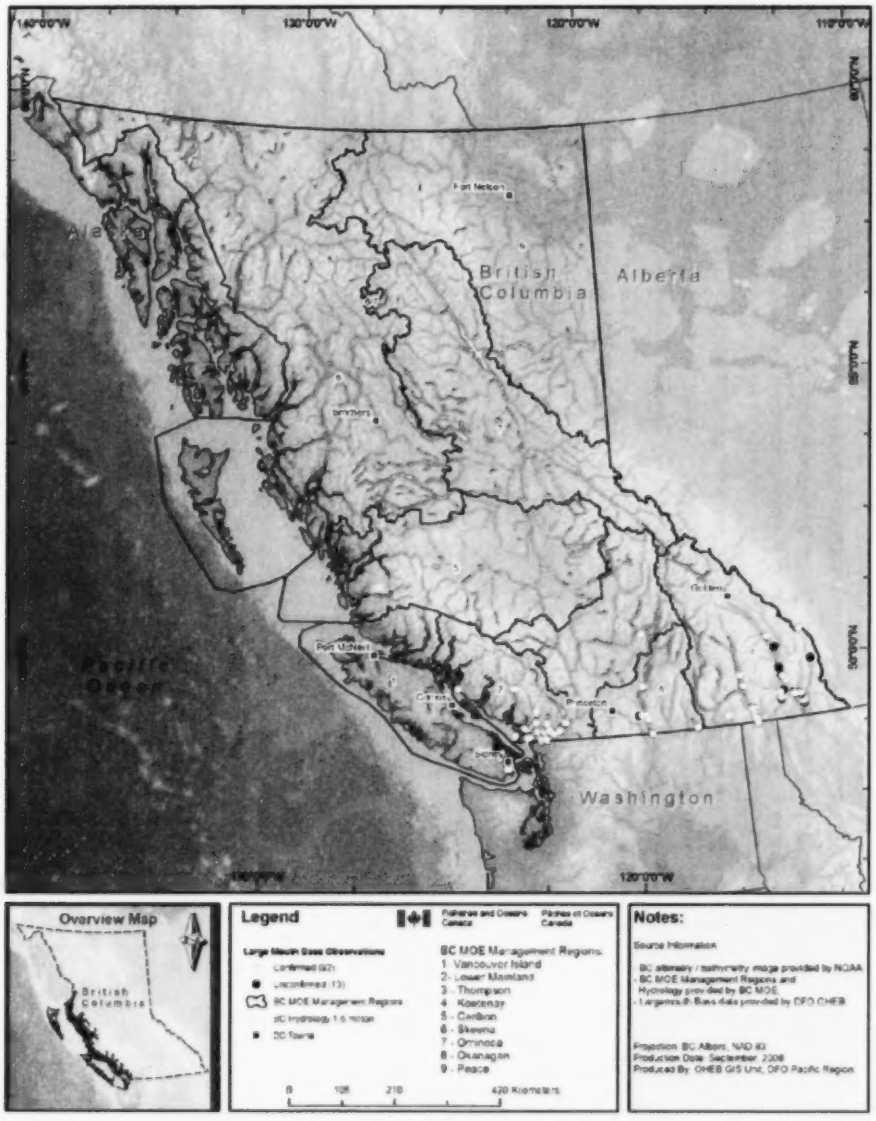


Figure 11 Confirmed and unconfirmed occurrence records of pumpkinseed in British Columbia as of November 2007.

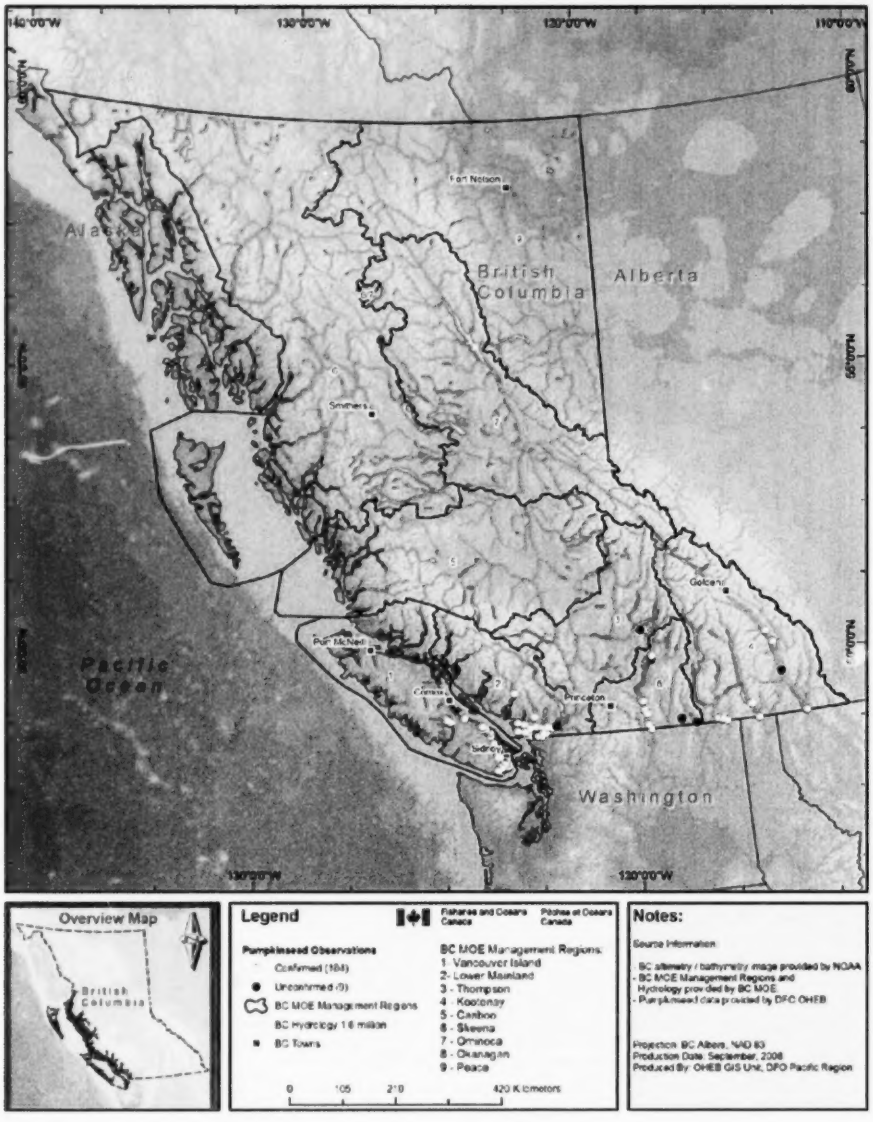


Figure 12 Confirmed and unconfirmed occurrence records of walleye in British Columbia as of November 2007.

Figure 13 Confirmed and unconfirmed occurrence records of northern pike in British Columbia as of November 2007.

Figure 12 Confirmed and unconfirmed occurrence records of walleye in British Columbia as of November 2007.

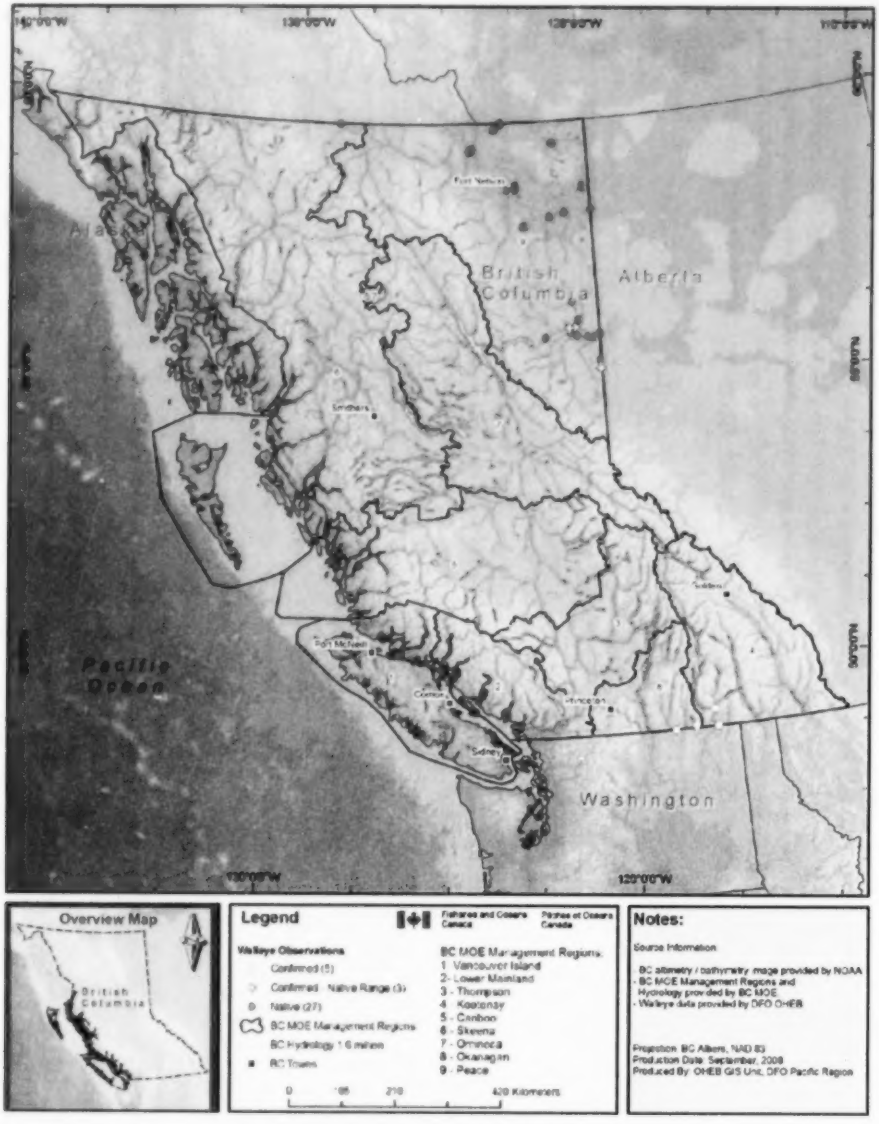
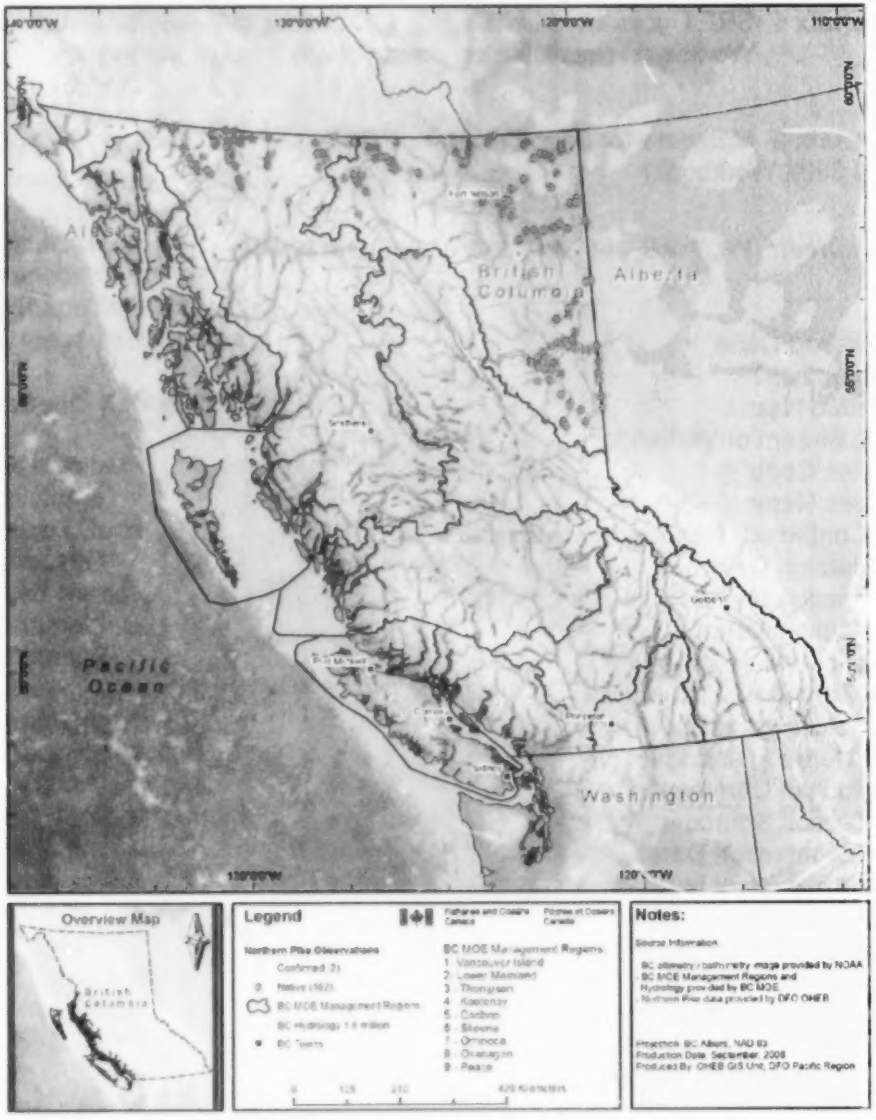


Figure 13 Confirmed and unconfirmed occurrence records of northern pike in British Columbia as of November 2007.



APPENDICES

Appendix 1 SRF Occurrence Data - July 17 2008.xls (Microsoft® Excel 2002 Workbook) (available on request from primary author)

Appendix 2 Metadata for SRF Occurrence Data - July 17 2008.xls (Microsoft® Excel 2002 Workbook)

Worksheet: YP, PMB, WP. NP, SMB and LMB Master

ID
Watershed Code
Waterbody ID
Gazetted Name
Lake, Stream or Wetland
Species Code
Species Name
(Un)Confirmed, Reported or Suspected
Introduction Date
Introduction Method
Introduction Count
Introduction Life Stage
UTM Zone (introduction)
UTM Easting (introduction)
UTM Northing (introduction)
Introduction Comment
Introduction Source
First Observation Date
First Observation Method
First Observation Count
First Observation Life Stage
First Observation Reproductive Status
UTM Zone (first observation)
UTM Easting (first observation)
UTM Northing (first observation)
First Observation Comment
First Observation Source
Total Number of Observations
Total Number Source
Last Observation Date
Last Observation Method
Last Observation Count
Last Observation Life Stage
Last Observation Reproductive Status
UTM Zone (last observation)

UTM Easting (last observation)
UTM Northing (last observation)
Last Observation Comment
Last Observation Source
Directed Fishery
Status of Fishery
Fishery Comment
Fishery Source
AIS Impact to Other Fishery
AIS Impact Comment
AIS Impact Source
AIS Management Plan
AIS Management Comment
AIS Management Source

Worksheet: Lakes - Physical

Region Number
Region Name
Watershed Code
Waterbody ID
Gazetted Name
Local Name 1
Local Name 2
UTM Zone (outlet)
UTM Easting (outlet)
UTM Northing (outlet)
Map Datum
Primary Mapsheet (outlet)
Elevation
Perimeter
Surface Area
Littoral Area
Depth (maximum)
Depth (mean)
Depth (Secchi)
Volume
Aquatic Vegetation Present
Wetlands Present
Inlets (permanent)
Inlets (seasonal)
Outlets
Temperature
Dissolved Oxygen
Alkalinity
TDS
pH

Bathymetry Available
Lake Physical Comment
Lake Physical Source

Worksheet: Streams - Physical

Region Number
Region Name
Watershed Code
Waterbody ID
Gazetted Name
Local Name 1
Local Name 2
UTM Zone (mouth)
UTM Easting (mouth)
UTM Northing (mouth)
Map Datum
Primary Mapsheet (mouth)
Longitude (DMS) (mouth) 1
Longitude (DMS) (mouth) 2
Longitude (DMS) (mouth) 3
Latitude (DMS) (mouth) 1
Latitude (DMS) (mouth) 2
Latitude (DMS) (mouth) 3
Survey Data Available
Number of Surveys
Order (total)
Magnitude (total)
Length (total) Length (invaded)
Discharge (maximum)
Discharge (minimum)
Discharge (mean)
Upstream Obstructions
Temperature
Dissolved Oxygen
Conductivity
Stream Physical Comment
Stream Physical Source

Worksheet: Biological

Watershed Code
Waterbody ID
Gazetted Name
Survey Data Available
Number of Surveys
Species Present (all)
Salmon Present
Connected to Salmon
Sportfish Present
Connected to Sportfish
Native Fish Present
Connected to Native Fish
Multiple AIS Present
Connected to AIS
Biological Comment
Biological Source